Trains

September
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Trains

Volume 3 Number 11

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Cover photo by Frank Taylor.

TWO years ago, who would have imagined a woman brakeman, in greasy pants and leather jacket, standing atop a box car, signaling the engineer? Even railroad clerical jobs have traditionally been filled by men, and train and engine service seemed about as far from a woman's world as even the War Manpower Commission could imagine. But now 102 women are working at jobs such as assistant road passenger conductors, road passenger brakemen and flagmen, and yard brakemen! Women in railroad office jobs have increased to 26 per cent of all such workers.

Just how the public will take to women in passenger-train service remains to be seen. The novelty hasn't yet worn off. Male passengers insist on opening the doors and traps for the trainwomen on Pennsylvania Railroad suburban trains, and the girls call them "train-door Johnnies." In ticket offices the pert, pleasant young women do a better public-relations job, in many cases, than the men. It may be because they are newer at it, but they seem to maintain their dispositions better under the strain of foolish questions and customers who change their minds.

Perhaps in many of the public-contact positions women are in the railroad business to stay. Probably in heavier types of work they are a purely temporary wartime expedient. Be that as it may, women are working on the railroads now in sufficient quantities to make a very real contribution to the winning of the war.

The Burlington Railroad has donated to the Newberry Library in Chicago 10 tons of general office records and correspondence covering the period from 1850 to 1887. These tell in detail of the early building and operation of the road, and will be available to scholars and writers.

The locomotive is an important war machine. The W. P. B. recognizes this and announces that American plants will build twice as many locomotives during 1944 as this year. All war-department and present private orders are scheduled. The private orders, all for delivery by the middle of 1944, are detailed on page 38 of this TRAINS. Additional orders from railroads will be scheduled for the second half of 1944, and indications are that they will be plenty. Motive power is being used to the limit, and many an obsolete locomotive has been forced back into active service. New power permits putting these old engines back into reserve, or scrap, so that the average efficiency of transportation is much improved.

The steam locomotive attains particular popularity in wartime orders because its construction uses less strategic material and also because it costs less per horsepower and thus cuts down the immediate capital investment to handle wartime traffic. Many of these new steam locomotives will look different, but beneath the trimmings there will be few fundamental changes because the W. P. B. has put the brakes on new designs which use the skilled work of patternmakers.

Passenger travel the country over is 264 per cent above 1939, according to F. E. Williamson, president of the New York Central. The increase is far from uniform in all sections of the country, with a 615 per cent gain in the Southwest against a 138 per cent gain in New England.

The important question is: After Victory, what? Like most businesses, the railroads are fairly affluent now, but because of labor and materials shortages they are not able to make needed track and equipment repairs now while they are financially able. These deferred repairs cannot be charged off against the present earnings, and so the railroads pay income taxes not only on the real income, but also on the money which should be spent on maintenance. After the war will there be the traffic to pay for all the deferred wartime maintenance? It would be only fair for the income tax people to allow the roads a reserve, without tax, equivalent to the maintenance which is being deferred.

A. C. Kalmbach.

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Bombs Away!

★ What do the railroads do when enemy planes attack their track and trains?

Courtesy British Railways.

By Lawrence W. Sagle.

In the dim moonlight of the British dim-out the gleaming rails lead past a quiet country station with its high platforms and quaint Victorian canopies. The air is still smoky from the last train down the line and the few late passengers have barely vanished down the village street, when the air-raid alarm sounds. A whir of planes is followed by a *"Poof!"* and the station is a mound of rubble, the railroad right of way a gaping hole and mess of twisted rails. The Jerries have struck again at that most vitally important war industry, railroad communication. And the British railways are ready, for the line is in service again within a matter of hours, and meanwhile trains are rerouted over other tracks with not more than minutes of lost time.

How about our own railroads? Have you ever wondered what our lines would do in the event of a real honest-to-goodness air raid? Well, don't worry too much. The railroads are prepared and know just what to do in such an emergency.

Preparedness for emergencies is nothing new to the railroads. Because there is little difference between the problem of a track or bridge being destroyed by a flood or by an air raid, the problem in either case being to have the track repaired and service restored in the shortest possible time, the railroads were far along the path of preparedness before hostilities started. They have always taken fires, floods and wrecks in their stride.

Let us suppose that an enemy raider has dropped a bomb on a freight train. The result is locomotives, cars and merchandise scattered over the landscape, and tracks torn up and twisted out of shape, with, perhaps, a resulting fire. The motive-power and maintenance-of-way departments go into action immediately, just as they would in the case of an ordinary wreck. As quickly as possible, the "big hook" is on its way to clean up the mess, and the maintenance-of-way train with ties, rail, ballast, and tools follows quickly. The railroad police are on hand, cooperating with the local authorities; ambulances are summoned to take the injured to the nearest hospital, the same as would be done in peace time; and in an unbelievably short time trains are again running over that section of the railroad.

Fully equipped wreck trains are maintained at strategic division points on the railroads. In addition to the large crane (and some of these are capable of lifting 200 tons at one time), there are cars containing all of the tools and tackle needed for the job. Other cars carry car trucks, ties, timbers, rail, and floodlights for night operation. There are cars for the men of the crew, including a well stocked dining car. The Baltimore & Ohio Railroad has recently added a fire-fighting car to most of its wreck trains, using the foamite method for smothering oil fires.

After war was declared, officials of the various railroads formulated additional plans to combat damage resulting from air raids. The maintenance-of-way departments have readily available records showing the exact location, at any time, of all needed equipment such as pile drivers, cranes, steam shovels, rail layers, work trains, etc., as well as where reserve stocks of rail, ties, track fittings, bridge timbers, piling, poles and other essential materials are stored. In many cases these stocks have been moved closer to the points where there may be a possibility of urgent need. This information is shared with neighbor railroads, and the supplies of one railroad may be requisitioned by another if its source of supply is closer to the place where it is needed. The plans include use of wrecking and construction equipment of other railroads, if, thereby, the damage can be more quickly repaired. The various railroads also have agreements permitting one road to detour

Next month:

Out of every 17 railroad passengers in the United States, one is on the Illinois Central's Chicago suburban service! At Randolph Street suburban terminal, 70 trains run over a three-track throat during one hour. Part of the IC main line has 10 tracks, six for suburban service. Read about this intensive railroad operation in the October TRAINS.

its trains over the tracks of another road when its own line is temporarily out of service.

Special trains of camp cars are maintained for transporting and housing locomotive- and car-shop men who may have to be rushed to some place to restore rolling stock to serviceable condition.

The possibility of sabotage is not so imminent as one might believe, for the police departments of the railroads are constantly on the alert. Bridges and tunnels are guarded, while watchmen and guards are constantly patrolling other railroad property.

What could happen in a concerted enemy attack in the event of invasion is another matter. In that case the military would step in and take over. Army engineers would then be available, in addition to railroad forces, and would supervise the repairs to tracks, bridges, and structures as a military necessity.

An air raid, however, is not only a possibility, but a probability that must not be overlooked. Repairing damage caused by the explosion of bombs would be "right down the alley" of the maintenance-of-way forces. Cleaning up debris and rebuilding track and structures would be more or less a routine matter. If a locomotive terminal were put out of service by a bomb, the motive-power department would service the locomotives and cars at the nearest terminal and, while very much irritated and somewhat inconvenienced, would keep the trains running.

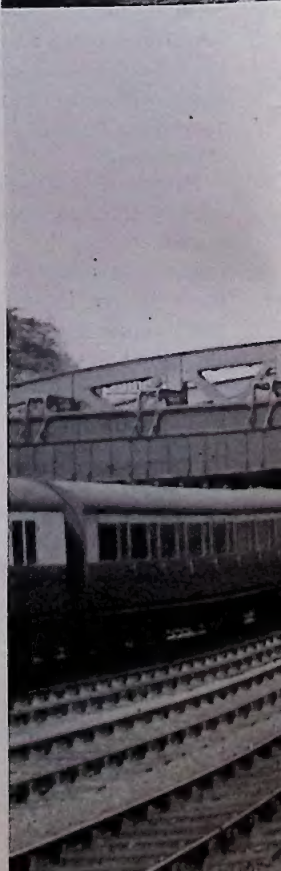
There is one phase of a bomb raid, however, that is outside of the experience of railroad forces, and that is the necessity for protection against potential damage from unexploded and delayed-action bombs and shells. Bombings in England, China, and American possessions have demonstrated this as a very real danger. The British have assembled and provided conclusive information to the effect that, through safety and certain precautionary measures, casualties and resulting damage from delayed-action and unexploded bombs can be reduced to a minimum. Precautions similar to those employed by the British are being taken in our country and especially by our railroads.

The trained railroad bomb reconnaissance agents of the railroads will cooperate with and assist other agencies *only* in the problem of finding, identifying and reporting unexploded bombs to the regularly designated authorities.

All unexploded bombs within 100 yards of a railroad will be reported by railroad officials direct to the control center or by wardens

A hit.

When a bomb came slanting down past the roof edge of Royal Oak suburban electric (tube) station near London, it not only smashed up track, the station platform, and parts of the station, but it blasted a dining car from the adjacent Great Western main line. Wrecking and maintenance-of-way crews were promptly on the job and it wasn't long before the scene was back to normal. Notice the four-rail system on the electric track. Instead of using the running rails for return current, both inside and outside third rails are used, one for each side of the power circuit. The current-collection rails are simply hung by their own weight over insulators, and this lessens the damage in case of accident. The complicated color-light signal just beyond the bomb damage apparently was not hurt at all. This signal governs traffic on its right-hand side.



Courtesy Great Western Railway (England).

VENOS
COUGH CURE
VENOS
COUGH CURE

Courtesy Southern Railway (England).

A tough nut to crack.

It was no easy job to get this multiple-track main line back into service after a bomb had demolished the bridges over a street, but repairs were quickly made and trains soon back in operation. Highway systems are more easily crippled than railways, since train wheels do not contact the loosely filled crater but ride on rails which distribute the weight evenly.

through the usual channels. They will report the exact location, including distance from the track, diameter of the hole of entry, type of attack (high or low altitude), nature of soil, whether on embankment or cut, or near bridges, etc.

A bomb-disposal officer will then reconnoiter all bombs and advise what precautions should be taken. Pending the arrival of the bomb-disposal officer, who is commissioned in the U. S. Army, the railroad police and other designated employees will take necessary precautions for the protection of life and property, and the local railroad officials must consult with the local control center regarding the application of these safety measures.

Since railroad traffic must be hindered as little as possible, rules have been formulated by the War Department for traffic control where a bomb has been found in or near railroad property. These cover speed restrictions, roping-off of property, evacuation of employees and others from the danger zones, and other necessary precautions.

The War Department has requested the railroads in probable combat zones to delegate bomb reconnaissance agents for the specific duty of locating, identifying, and reporting to the army through designated civilian defense centers the presence of unexploded bombs on or immediately adjacent to railroad property or facilities. The War Department will assume the responsibility for the disposal of unexploded bombs, through its "bomb disposal" organization consisting of officers and enlisted men of the army. They must, of necessity, be informed of the presence of such bombs, and it is this information that the railroad employees will procure and transmit to the army.

In order to carry out this plan intelligently, classes were formed throughout the country to instruct men selected by the railroads for this duty. The plan was to select at least one senior bomb reconnaissance agent for each specific location, that person to be one who can make immediate decisions, act as a liaison between the management and the army, and protect railroad interests in all matters pertaining to unexploded bombs.

In addition to this, the railroads have issued to all of their operating employees rules and regulations for use during blackouts and air-raid alarms.

The railroads are on their toes, and so well are they organized that nothing short of a catastrophe could seriously cripple them. No air raid could shut off even a part of their lines for long, and with their many parallel and alternate routes, traffic would quickly be shunted from one to another and keep on rolling.

Kane, Pa., in 1865.

The railroad is the Philadelphia & Erie (now PRR) and the primeval hemlock forest in the background has long since been cut. The building under construction at right was a stone roundhouse.

Collection of Granville Thomas, Millville, N. J.

Crystal River & San Juan

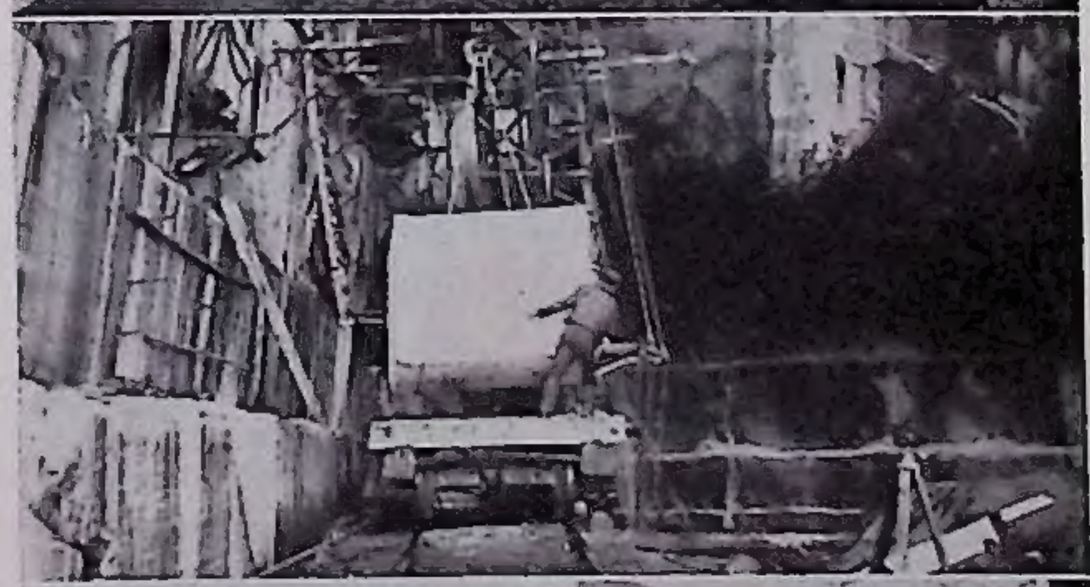
★ A marble railroad in the Colorado Rockies.

By Morrison A. Smith.

DEEP in the heart of the Colorado Rockies, not far from Glenwood Springs, well known resort town on the Denver & Rio Grande Western main line, is a beautiful valley through which flows the well named Crystal River. A little-known railroad, the Crystal River & San Juan, once followed this valley between Carbondale and Marble, and over this line passed many carloads of cattle and sheep and coal. Most important to our story, however, was the transportation of millions of cubic feet of snow-white marble which today adds much to the beauty of numerous buildings and parks in American cities. It was this marble which supported the railroad, and lack of this business caused abandonment in 1941. The line was dismantled in 1942.

Discovery of coal deposits in the Coal Basin area brought a 20-mile railroad, the Crystal River Railroad, to Placita from Carbondale, on the Aspen Branch of the D&RG and near the main line of the now-abandoned Colorado Midland Railway. This construction occurred in 1899 as an extension of two older lines. A 12-mile narrow-gauge branch from Redstone to Coalbasin was built in 1901, and a number of coking kilns were set up at Redstone to manufacture coke from the product of this branch. By 1906 another line, the Crystal River & San Juan Railroad, had been extended 7½ miles to Marble, at the end of the valley, where vast deposits of slate and marble were being developed.

Before we visit the quarries and finishing mills of this industry, perhaps it would be interesting to trace the development of the area in which they were situated. The first recorded reference to the marble deposits in this location, known as the Treasury Mountain Area, was in *Mineral Resources of the United States,* in 1882. In succeeding years this publication recorded other bits of information; the report of 1885, for instance, states: ". . . a bed of remarkably



Top, L. C. McClure; others, M. A. Smith.

Upper left: An inch and a half from the top and two inches from the left side of the picture is a faint stretch of track, part of the CR&SJ right of way. This continued to the right, following the banks of the Crystal River to mines and quarries between the broad plateau and Mount Sopris in the background. To the left of the visible CR&SJ trackage is Carbondale, where a wye connection was made with the D&RGW Aspen Branch, shown as a diagonal line. In the foreground is the Roaring Fork River, along the near bank of which can be seen the tracks of the long-since-abandoned Colorado Midland. Lower left: CR&SJ No. 2 hauling three cars at 15 miles per hour. Top right: CR&SJ trackage paralleled the Crystal River between Marble and Carbondale. Center: Removing a block of marble from Yule quarry. Lower right: Colorado state capitol annex in Denver, constructed of Yule marble.

Trolley section to the Yule quarries. M. A. Smith.

fine marble was opened up during the year on one branch of Rock Creek." It was not until 1896, however, that commercial production was mentioned, when it was stated that Colorado was producing marble for a public building in Denver.

Large-scale production did not begin until two years after the completion of the railroad into Marble, when the Colorado Yule Marble Company was founded. In the next few years production increased steadily, advancing the output until this company had risen from tenth to fourth place in the industry.

Marble was hauled from the quarries to the mills—a distance of 3½ miles—by teams or a steam tractor, until 1910, when an electric railroad was completed over this route. This branch contained steep grades and sharp curves; one of the interesting features of the operations was the handling of huge blocks of marble down grades as steep as 17 per cent.

During the years 1908-1910 the expansion program was at its height. The fabricating shops and sawing mills were completed, two hydroelectric plants were built, and an auxiliary steam plant was constructed to furnish electric power for the quarries, mills, and shops.

Due to financial difficulties, the business was put into receivership and finally closed down from 1917 to 1919. By 1922, operations of both railroads and of the quarries had been resumed under control of Wilkes-Barre and Denver interests; these groups merged in 1924 to form the Colorado Consolidated Yule Marble Company, which was subsequently sold to a Tennessee quarrying company.

A disastrous fire in April, 1925, caused further uncertainty as to the future of the company, due to destruction of a considerable portion of the shops and mills, and after additional changes of ownership the property was finally purchased by the Vermont Marble Company, in 1928. This company began a program of rehabilitation, and operated the quarries and mills continuously until 1941, when lack of business caused virtual discontinuation of the mining and milling industries, and abandonment of the railroad.

The purity of this white marble is unequaled throughout the world. In appearance it resembles the Parian and Carara marbles of Italy, although the Yule product is harder and more durable; its surface can be exquisitely polished, and its chemical composition does not allow disintegration or discoloration from absorption.

Buildings built partly or entirely of Colorado Yule marble may be found in all parts of the country; some of the larger ones include the municipal buildings in New York City, San Francisco, and Denver; the new Field Building in Chicago; and the Pan-American Building in Los Angeles. Well known memorials include the Lincoln Memorial and Tomb of the Unknown Soldier in Washington, D. C.; the Elliott Memorial in Manchester, N. H., and the memorial at Huntington Park, Calif.

The deposit itself consists of a continuous cliff from 75 to 150 feet in height and more than 4000 feet long, extending into the mountainside for an inestimable distance. Other beds in the same locality increase the total underground area to at least 15 square miles, of unguessable depths, although these are less accessible than the main outcropping. Core drillings made at various points show 60 per cent of the marble to be lightly colored, and 40 per cent to be pure white. Of the colored marble, the type known as Statuary Golden Vein, which is pure white with golden veins, is one of the best-known types. In addition to the pure white variety, the "Colorado Cloud," consisting of pure white with light

Geneology of the railroads of Crystal River.

1886 Aspen & Western incorporated. Controlled by Colorado Fuel & Iron Company.

Construction:

1888 13 miles, Carbondale-Thompson Creek Mines, three-foot gauge. (D&RG reached Carbondale, 1887.)

Leased:

1891 For short time to D&RG.

Foreclosed and Sold:

1892 To Crystal River Railway.

1892* About this time the portion of the line from Willow Park to Thompson Creek Mines must have been abandoned.

1892 Crystal River Railway incorporated. Controlled by Colorado Fuel & Iron Company.

Lines Acquired:

From Aspen & Western—

3.5 miles, Carbondale-Thompson Creek. (Changed to standard gauge.)

6.4 miles, Thompson Creek-Willow Park. (Remained narrow gauge.)

Construction:

1897* 8.6 miles, Thompson Creek-Hot Springs.

1897* Name apparently changed to Crystal River Railroad Company.

Foreclosed and Sold:

1898 To Crystal River Railroad.

1898* About this time the narrow-gauge line to Willow Park must have been abandoned.

1898 Crystal River Railroad incorporated. Controlled by Colorado Fuel & Iron Company.

Lines Acquired:

1898 From Crystal River Railroad Company—12.1 miles, all standard-gauge track.

Construction:

1898 4 miles, Hot Springs-Redstone.

1899 4 miles, Redstone-Placita.

1901 11.83 miles, Redstone-Coal Basin. three-foot gauge.

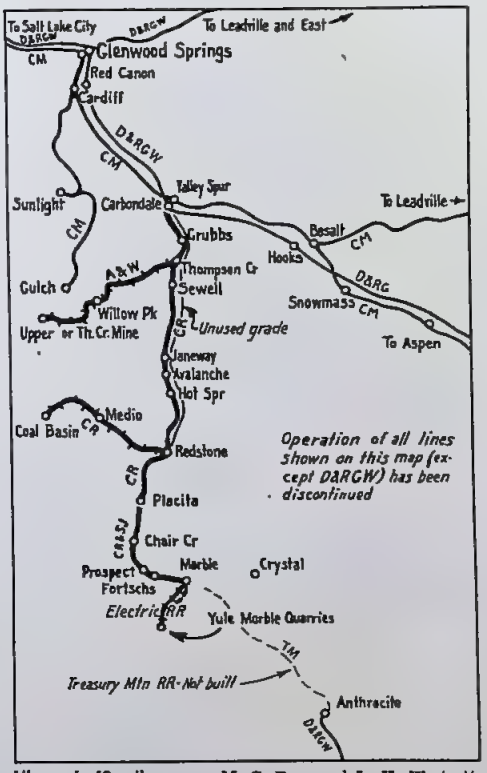
Operation Suspended:

1914 11.83 miles, Redstone-Coal Basin. Three-foot gauge. (Track dismantled some time later.)

1917 20.1 miles, all lines.

Leased:

1922 To Crystal River & San Juan Railroad Company.



1" equals 12 miles. M. C. Poor and L. H. Westcott.

1907* Crystal River & San Juan Railway incorporated. Controlled by Vermont Marble Company since 1928.

Construction:

1907 7.36 miles, Placita-Marble.

Leased:

1907 From Crystal River Railroad, 3.5 miles of grade for above construction.

Operation Suspended:

1917 All lines.

Leased:

1922 To Crystal River & San Juan Railroad Company.

1906 Crystal River & San Juan Railroad Company incorporated. Controlled by Vermont Marble Company since 1928.

Leased:

1922 From CR&SJ and CR—27.46 miles, Carbondale-Marble.

Operation Suspended:

1941 All lines.

* An asterisk beside the date indicates that the time is only approximate.

Data from Poor's and Moody's Railroad Manuals.

cloud effects, has also come to be very well known.

The quarries themselves are almost entirely underground; openings were made near the tops of the cliffs, and as the marble was removed the various "rooms" became larger and larger. Electric air channeling machines cut the blocks to the dimensions required, usually from the floor of the quarry; they were then raised from their beds by feathers and wedges, lifted by immense steel derricks and loaded on a hoist. A three-inch cable was used outside the quarries to lower the blocks to the cars waiting at the end of the electric line, on which they were transported to the shops and finishing mills for cutting, shaping and polishing.

The largest block of marble quarried, that for the Tomb of the Unknown Soldier, measured 6 x 7½ x 14 feet, and weighed 56 tons.

Steam locomotives used on the railroad in recent years consisted of one Ten-Wheeler, acquired from the D&RG in 1915, and two Moguls, sent to Colorado from the Clarendon & Pittsford, another railroad controlled by the Vermont Marble Company. The electric branch was operated by two locomotives, and an electric rotary snowplow aided in keeping the line open in Winter. When the narrow-gauge line was in operation, three 2-8-0 engines provided the motive power; these are still in existence, working at the present time on the D&RGW with the numbers 360, 361, and 375. Cars were usually provided by other railroads, although an old combination car acted as caboose and passenger car on the three-days-a-week mixed train bebetween Marble and Carbondale.

Rolling stock of the Crystal River lines.

These two chunky locomotives were two-thirds of the CR&SJ (standard gauge) roster. The third locomotive is another Mogul similar to No. 2. Two of the standard-gauge locomotives are still for sale by Morse Brothers Machinery Company, Denver, which bought the physical properties of the railroad on abandonment in 1941. The affiliated Crystal River Railroad (three-foot gauge) had three Consolidations, details of which are given below.

No.	Type	Drivers, Diameter, inches	Cylinders, D. & S., inches	Weight on Drivers, pounds	Total Weight, pounds	Tractive Effort, pounds	Builder and Builder's No.	Date Built	Notes
1	4-6-0	54	18 x 24	81,500	109,000	17,924	Baldwin 11717	1891	Originally D&RG 532
2	2-6-0						Baldwin 20459	1902	Originally C&P 5
3	2-6-0						Baldwin 29826	1906	Originally C&P 6
101	2-8-0	39	17 x 20	85,650	95,650	20,686	Baldwin 17872	1900	Originally D&RG 430, later D&RGW 360
102	2-8-0	39	17 x 20	85,650	95,650	26,686	Baldwin 17717	1900	Originally D&RG 431, later D&RGW 361
103	2-8-0	38	18 x 20	107,400	117,400	24,641	Baldwin 21757	1903	Originally D&RG 432, later D&RGW 375

Nos. 1, 2, and 3 are Crystal River & San Juan Railroad (standard gauge); the 100 series are Crystal River Railroad (three-foot gauge).

What the Signals Say

☆ Signaling has developed with the railroad, making possible the high speeds and safety of today.

C&NW signals at Evanston, Ill. Photograph by Homer R. Hause, 1013 Judson Ave., Evans

*By Henry T. Wilhelm.**

THE signals stand alongside the railroad track, semaphore arms pointing invitingly upward or color lights brightly shining. What story do they tell the engineer? Green in a general way means "all clear," of course, and red in as general a way means "stop." But with multiple-light signals and semaphores of two and three arms the story is obviously much more complicated than the simple stops and goes of the corner traffic light.

Yet, like the corner traffic light, railroad signals have a function which is far more than the negative one of prevention. The signals speed up traffic, allow more trains to move over the track, and with safety and precision. Originally the signal was primarily a safety device, and it is still a fundamental axiom in signal design that any possible failure of the mechanism must react on the side of safety. But as the art of railroading has progressed, the art of signaling has developed equally, and with it has come the more positive concept of signaling as an operating tool, to permit more efficient operation.

Modern signaling practice involves the basic principle of giving the engineer such information that he can run at maximum allowed speed, and still know in plenty of time any conditions which require speed reductions. Present-day signaling means far more than block signaling to tell whether trains are ahead. It means proper spacing of signals in relation to train speeds and braking distances, advance indications for diverging routes at junctions, signaling for runaround moves, centralized traffic control (C. T. C.) which allows the dispatcher to control the meeting and passing of trains directly from his desk by signal indications rather than secondhand by train orders, and cab signals which at all times tell the engineer, right in his cab, of the track conditions ahead.

A signal is essentially any device or method used to convey some information. Thus, in addition to the roadside signals we all know, there are hand, flag, lantern, whistle, horn, torpedo, and fusee signals. The term "fixed signal" refers not only to semaphore and light signals but to any other signals permanently installed along the right of way, such as speed-limit boards, yard-limit signs, whistle posts, and so

* Historical data based upon *Development of Railway Signaling*, by Herbert S. Balliet, Railway & Locomotive Historical Society Bulletin 44. Aspects and indications are based upon *American Railway Signaling Principles and Practices*, Signal Section, A. A. R.

on. When we speak of signal systems we ordinarily consider only the operating fixed signals, but it is of interest to note that flags and lanterns are provided at many locations for emergency signaling, and sometimes they are used for regular direction of train movements. At a busy intersection of three railroads in Chicago, white, green, and yellow flags or lanterns were used for many years as the proceed signals for the three respective railroads.

In the Jersey City terminal area, electropneumatic whistles have been used in some of the interlocking towers for directing back-up moves. A number of years ago, the block system on Cape Cod consisted of a red flag which the station agent inserted in a hole in a tie after a train had passed. More important is the use of unattended block stations in manual-block territory on the Pennsylvania Railroad. These unattended block stations are essentially block-limit signs designated by name or call letters, and consist of a fixed red and yellow light with a telephone over which the train crew receives instructions.

All of these arrangements are, however, the exception, and the usual signaling practice consists of systems of operative signals such as semaphores or light signals operated either manually, automatically, or by a combination of these two. Present-day signaling had its origin in the nineteenth century and it is interesting to look back at its development.

The earliest fixed signals for railway use appear to be disk signals installed on the Stockton & Darlington Railway in England in 1827. Essentially, a flat disk turned toward the engineman indicated stop; when turned edgewise, it indicated proceed. This was the forerunner of the switch target, probably still the most common form of signal in existence. Almost every railroad uses some form of target on hand-operated switchstands to indicate the position of the switch, although many roads omit switch targets in automatic-signal territory. Pot signals or switch targets were commonly used toward the end of the nineteenth century as dwarf signals at interlockings. Most of the signals on the Sixth Avenue Elevated in New York City (removed in 1939) were pot signals. On the Santa Fe it is general practice to use switch targets on interlocked facing-point switches as route indicators.

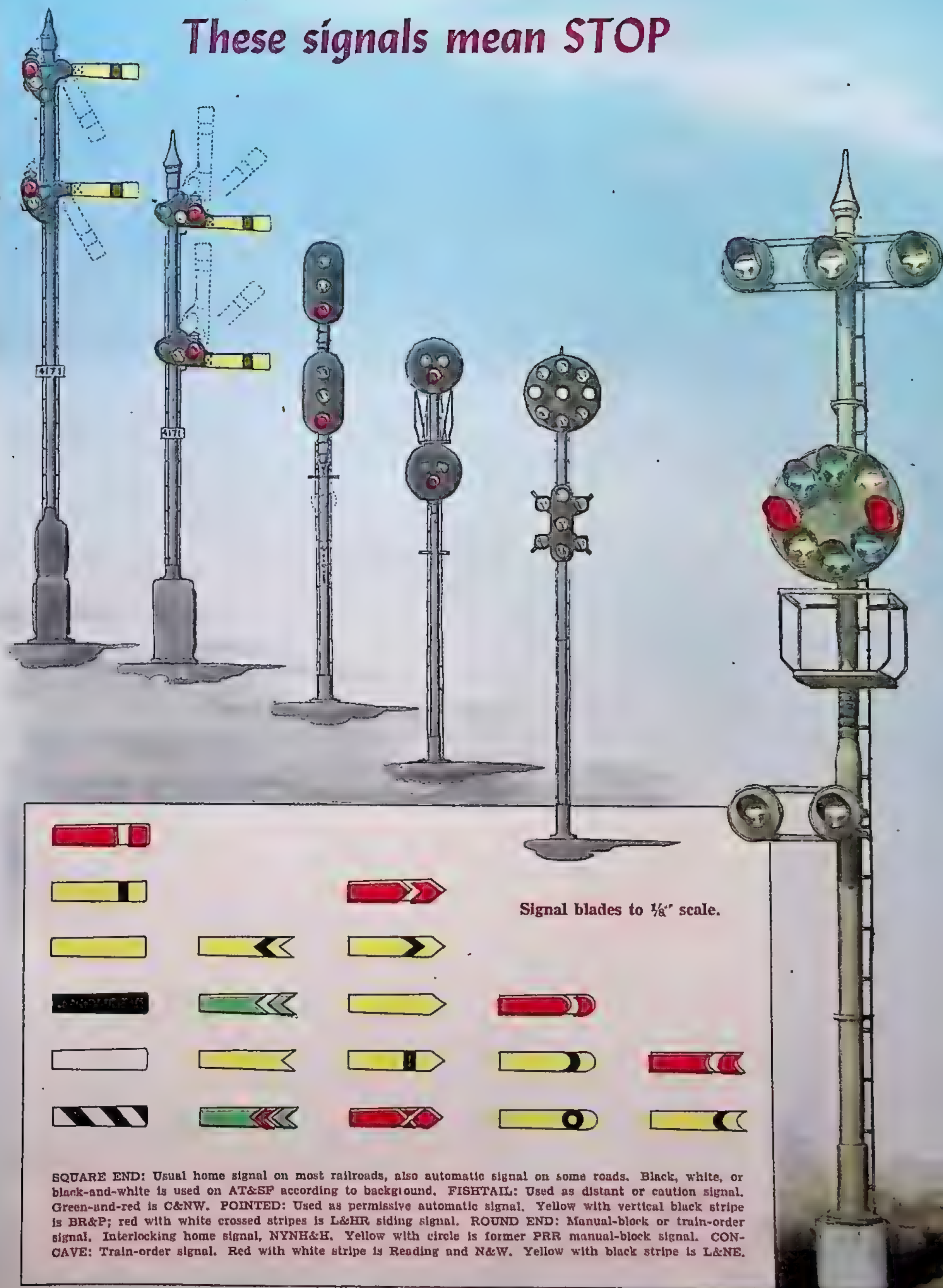
Another early form of signal which was used at crossings or junctions is the ball signal, originally known as the "highball." It appears to have been first used in America in 1852 on what is now the New Haven Railroad. It consists of a light hollow ball hauled to the top of a pole by a rope, indicating clear when raised, danger when lowered. By night a lantern (usually red) is hooked on in place of the ball. Ball signals were most commonly used in New England, and many installations are still in service. At complicated junctions, two, three or more balls are used to designate which route is clear. The signals are usually operated by switchtenders.

Another early type of signal used at crossings is the pole target or tilting board, in use in America since 1855. It consists of a center pivoted board at the top of a pole. A red lantern is hung from each end of the board for night indications. In the horizontal position the target indicates proceed on one railroad; inclined, it indicates proceed on the other. Ordinarily trains are required to stop before proceeding over crossings thus protected. An alternate form of protection used in America since 1860 is the crossing gate, usually arranged to swing across the tracks from one railroad to the other. Sometimes gates are interconnected with semaphores or other signals. Gates are ordinarily used only across railroads with very light traffic, and are therefore operated by train crews. A more recent device which serves the same purpose as a gate is the smash board or smash signal. Resembling a semaphore, a smash board is arranged to obstruct the path of the locomotive so that failure to observe a stop indication leaves evidence in the form of a broken board.

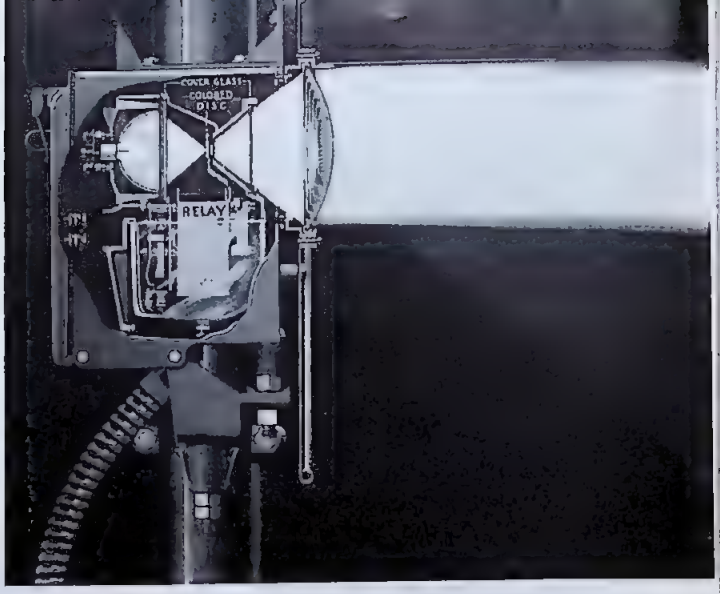
Two other types of signals should be mentioned. One is the banner signal, a two-position clockwork-operated automatic block signal, some of which are still used on the New Haven

The family of railroad signals has many branches, with the semaphore signal and its nighttime color-light indications as the common ancestor. The principal signal types are (left to right) the early lower-quadrant semaphore, the now more standard upper-quadrant semaphore which has three positions of the blade instead of two, the color-light signal with the three colors in a vertical row, the same signal with the colors arranged in a triangular pattern, the single-lens searchlight signal, the position-light signal in which the angle of the row of lights gives a light pattern similar to the semaphore, and the color-position light signal which combines color and the angle of the row of lights. In all cases the stop indication is shown, with the other lens colors indicated faintly. The semaphore arms below are to exact scale and color, and show the various types of blade on the many roads using semaphores.

These signals mean STOP



SQUARE END: Usual home signal on most railroads, also automatic signal on some roads. Black, white, or black-and-white is used on AT&SF according to background. FISHTAIL: Used as distant or caution signal. Green-and-red is C&NW. POINTED: Used as permissive automatic signal. Yellow with vertical black stripe is BR&P; red with white crossed stripes is L&HR siding signal. ROUND END: Manual-block or train-order signal. Interlocking home signal, NYNH&H. Yellow with circle is former PRR manual-block signal. CONCAVE: Train-order signal. Red with white stripe is Reading and N&W. Yellow with black stripe is L&NE.



after about 50 years of service. These signals resemble a high switch target, and are usually located a short distance beyond the entrance to the block so that the engineman can observe their operation as the train enters the block. A more common signal is commonly called a "banjo" signal from the shape of the housing. These signals were widely used as automatic block signals on the IC, C&NW and LV, and many are still in service on the Reading.

By far the most important form of signal developed during the nineteenth century was the semaphore. The Gregory semaphore, first used in England in 1840, was a three-position lower-lefthand-quadrant semaphore, but at the request of British railway officials was arranged to operate in two positions only. Semaphore signals came into general use in America during the 1870's, and were usually two position lower-righthand-quadrant signals, with the arm in the horizontal position for the restrictive indication and 60 degrees downward for clear.

For about 50 years, until the development of light signals, semaphores were the standard method of signaling on American railroads. Semaphores have been used as block signals, for train orders, interlockings, draw bridges, station or flag signals, and as switch indicators. Semaphore mechanisms have been mechanical, electromechanical (slotted), pneumatic, gas, electropneumatic, and electric. Two important factors which account for the widespread use of semaphores are the introduction of interlocking in 1870 and the invention of the track circuit in 1872.

Because of the widespread use of semaphores during the past 50 years, it is not surprising that many varieties have come into use. The early lower-quadrant semaphores had several faults, and various improvements were made to overcome them. If an arm became weighted with snow, a defective signal might fall into the clear position. This was overcome by the banjo signal, and more commonly by the upper-quadrant signal adopted since about 1903 by most railroads. Another fault was the use of white light as a nighttime proceed indication, green being used for caution. If the red or green signal roundel was broken, a false clear indication resulted. This problem was solved by using green for proceed and yellow for caution. Most railroads made the substition by about 1920. The B&O, the Wabash, and the Milwaukee were among the last large roads to change over. The C&NW solved the problem by using a combination of red and green for caution, and devised a special form of semaphore for the purpose. As semaphores were put to more varied uses, it became desirable to use various shapes and colors of arms in order to differentiate the various types of signals. The principal varieties of semaphore arms used in America are shown on page 15.

Before 1900, semaphore arms were usually colored red except for distant semaphores, which were green. As the various roads changed the color of the night caution indications to yellow, the distant semaphores were painted yellow to correspond. Some railroads found that the yellow arms gave better visibility than the red arms, and therefore decided to paint all their semaphore arms yellow. Among the roads which now use yellow arms exclusively are the PRR, B&O, CNJ, L&NE, ACL, CofG, C&EI, Frisco, L&N, Rock Island, CGW, and KCT. The Erie uses red arms on some divisions and yellow on others. The BR&P (now B&O) uses yellow arms for permissive automatic signals, and red arms for other signals. The N&W used red arms except for dwarf and call-on signals, which had yellow arms. The Santa Fe uses black, white, or alternate stripes of black and white, depending upon the background. (Another distinctive practice of the Santa Fe is the use of one-arm signals at interlockings, regardless of the num-

The searchlight signal, shown in a typical installation at right and in section at left, produces a much brighter beam than the conventional color-light type with its separate light and lens for each color. The operating relay moves a vane on which are mounted small disks of colored glass. These fit into the beam of light right at the sharp focal point caused by the perfect parabolic reflector behind the light bulb, and thus color the beam for the appropriate indication. In the conventional color-light signal the beam-power depends on the lens rather than on the reflector, because reflectors might mirror sunlight or other outside light sources so as to give false indications when the lights are off, but in the searchlight such a false indication is obviously impossible. Below is a much be-signaled junction at Rollinsford, N. H., on the B&M, with searchlight signals at the junction, semaphores barely visible in the distance, and an old highball signal at the right.

Union Switch & Signal Company.

ber of routes. A 90-degree or green signal indicates main route, while a yellow in combination with indications on switch targets at the switch points indicates which diverging route is set up.)

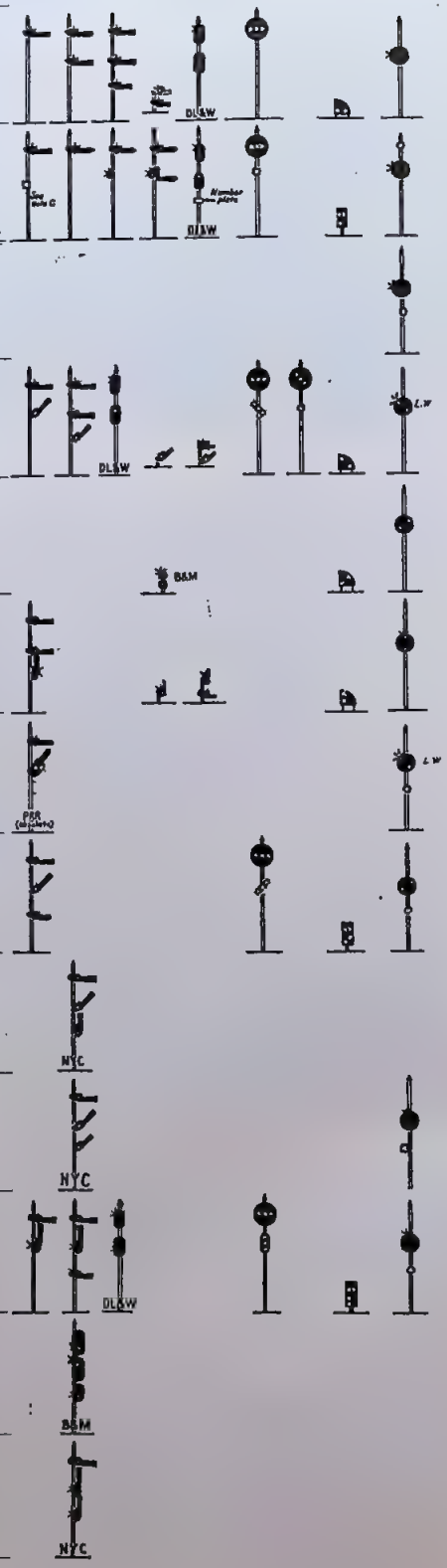
With the extension of automatic block systems through interlocking plants, some railroads found it necessary to increase the number of arms on a mast. On the Electric Division of the NYC, for example, as many as five lower-quadrant arms were used. With the conversion to three-position upper-quadrant signals, where one arm takes the place of a separate home and distant arm, it is customary now to use not more than three arms regardless of the number of routes. In British signaling it was for many years considered essential to have a separate signal for each route. American practice, however, inclines to speed signaling in which the top arm governs the high-speed route, the middle arm governs all medium-speed routes, and the bottom arm governs low-speed routes.

With the construction of subways and the need for signals in railroad tunnels came the evolution of the color-light signal. The difficulty in early color-light signals was in obtaining suitable electric lamps and relays. Thus the signals in the original New York subway were electropneumatic slide-type signals in which a vertical slide with colored roundels was raised into place in front of a fixed electric lamp. Probably the first installation of modern color-light signals was in the East Boston tunnel of the Boston Elevated Railway in 1904. By 1915, the New Haven experimented with color-light signals for outdoor use, and since then many railroads have used color-light signals.

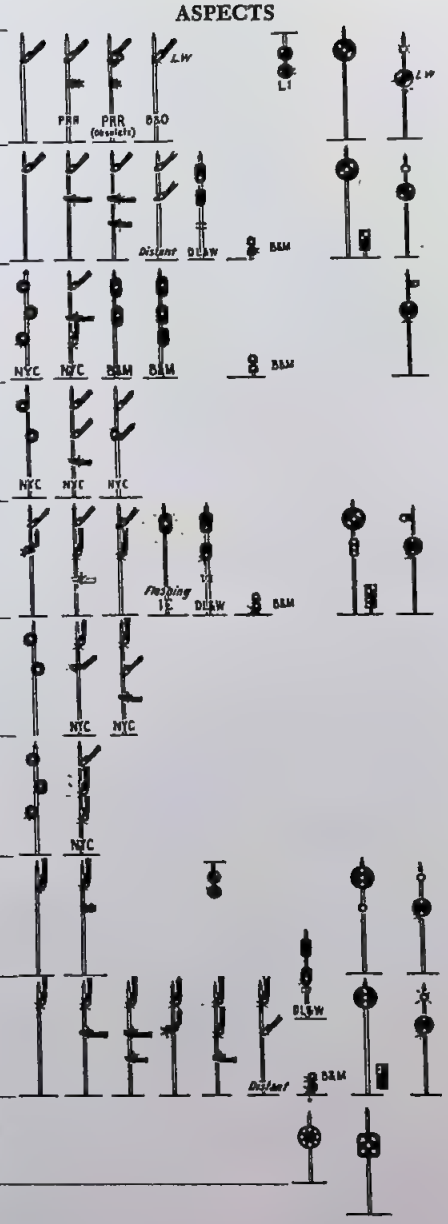
There are four basic arrangements of color-light signals: vertical, triangular, horizontal, and the single-lens or searchlight type. Most railroads use the vertical type, where the red, yellow, and green lights are placed in a vertical line. Red is usually the bottom light. Several roads use the triangular type, and the horizontal type has apparently been used only by the C&NW and the Reading. The searchlight type uses a single clear lens with a miniature signal spectacle with green, red, and yellow filters interposed between the light and the lens. The

Union Switch & Signal Company.

	INDICATION	ASPECTS
1a	Stop.	
1b	Stop, then proceed prepared to stop for obstruction.	
1c	Stop, then proceed on diverging route prepared to stop for obstruction.	
2a	Proceed at restricted speed, prepared to stop for obstruction.	
2b	Proceed at slow speed, prepared to stop at next signal.	
2c	Proceed at slow speed.	
3a	Proceed on diverging route into occupied block. Permissive manual-block indication which is generally restricted to nonpassenger trains following a nonpassenger train. Manual-block aspects are usually distinguished by shape of arm, marker, or special instruction.	
3b	Proceed at medium speed, prepared to stop at next signal.	
3c	Proceed at medium speed, prepared to pass next signal at slow speed.	
3d	Proceed at medium speed, prepared to pass next signal at medium speed.	
3e	Proceed at medium speed.	
3f	Proceed at medium speed through interlocking, then resume normal speed.	
3g	Proceed at limited speed within interlocking limits.	



	INDICATION	ASPECTS
4a	**Proceed over main route into occupied block.** Permissive manual-block indication which is generally restricted to nonpassenger trains following a nonpassenger train. Manual-block aspects are usually distinguished by shape of arm, marker, or special instruction.	
4b	**Proceed prepared to stop at next signal. Reduce speed at once to not more than medium speed.**	
4c	**Proceed prepared to pass next signal at slow speed.**	
4d	**Proceed prepared to stop at second signal.**	
4e	**Proceed prepared to pass next signal at medium speed.**	
4f	**Proceed, approach second signal at medium speed. All NYC practice.**	
4g	**Proceed prepared to pass next signal at limited speed. All NYC practice.**	
5a	**Proceed, manual block is clear. Second and third signals are PRR and LI practice.**	
5b	**Proceed.**	
Special	On the Pennsylvania a ring of lights means lower pantographs for a change in power phase. The X is take siding.	



Commonly used signal indications and aspects.

The indication is what the signal says to the engineer. The aspect is how the signal says it. Almost every railroad has some variations of its own and an all-inclusive chart of what the signals say is nearly impractical. But this chart shows the typical signaling practices, derived from both the special indications of large roads and the standards of the A. A. R. Naturally, all possible aspects are never used with any one multiple-arm signal. The aspects shown for position-light and color-position-light signals are peculiar to those types alone, but the aspects shown for the semaphore signals include the nighttime light aspects which are also the aspects used with color-light signals to mean the same thing. There is no point, thus, in showing both semaphore and color-light, except in the few special cases where the semaphore is never used, such as the DL&W and B&M color-light aspects, and certain NYC aspects shown only with searchlight signals.

Note G: On some railroads certain automatic block signals have a yellow disk, or a disk or marker with the letter G or P. Such signals are known as grade signals. When such signals display aspect 1b, tonnage freight trains are permitted to pass the signal at slow speed without stopping.

mechanism which operates the spectacle takes the place of a relay for the other type of color-light signals. The searchlight signal is compact, neat, and efficient, and is gradually superseding the other types of signals on many railroads. It is of interest to note that all three-position color-light signals use green, yellow, and red (or purple in the case of some dwarf signals) for the three aspects. The C&NW formerly used red-and-green for caution in semaphores but now uses yellow in color-light signals and most semaphores alike.

While the PRR has used color-light signals in the New York terminal area since 1910, it was felt that a signal in which both day and night indications were given by position would be preferable. Accordingly, the now-famous position-light signal was developed about 1915 with indications given by rows of three (originally four) yellow lights. Originally, only three positions were used, corresponding to the positions of an upper-quadrant semaphore, but a lower-quadrant diagonal was soon added for use as a permissive or caution indication. Dwarf and pedestal signals (miniature high signals) use only two lights in a row and they are white instead of yellow. Standard position-light signals are in use on the PRR, LIRR, N&W, Union Railroad, P&LE and LV, although the two latter roads are now installing color-light signals in place of position-lights, and the N&W aspects are somewhat different from the standard aspects. The Chicago Union Station Company uses a modified form of position-light signal. Several other roads, including the Erie and Nickel Plate, used position-light dwarf signals for a while, and the Erie is still using high position-light signals as telephone train-order signals. It is of interest that position-light dwarf signals have been used in England and Sweden in conjunction with color-light high signals.

The B&O has developed a distinctive signal known as the color-position type. Indications are given by two red, yellow, green, or lunar-white lights positioned to correspond with the position-light type. In addition, vertical or staggered upper or lower white marker lights are used as route indicators to multiply the number of indications which can be given. The signals have the advantage that if one of the two colored lights fails, the other will still give the indication by color. These signals appear to be used only on the B&O and roads controlled by it, such as the Staten Island, the Alton and the BR&P. Incidentally, railfans visiting New York City should not overlook the opportunity to ride over the Staten Island Railway. Service is given by M. U. trains, and passengers are permitted to ride the front platform and observe these interesting signals in action. The line between St. George and Clifton Junction is especially interesting, as three-block signaling is provided for the close headway.

The train-order signal is a distinctly American invention, having come into use after 1851, when train orders were first used on the Erie Railroad. In the early days, banner signals (rotary disk signals) were used as train-order signals, but the usual practice now is to use two semaphores (one for each direction) mounted on a single mast, usually adjacent to the station or tower used as the train-order office. Some of the Western roads require that train-order signals be left normally at danger, and cleared only in sight of the engineman of an approaching train, but on most roads they are left cleared normally.

Several large Eastern roads do not use semaphore train-order signals at all, but use a yellow or red flag or lantern at the tower to indicate "19" or "31" orders, respectively. In this case, the block or interlocking signal is held at danger until the engineman acknowledges the train-order signal by whistle. For about 30 years, the Erie has used a system of telephone train-order signals remotely controlled by a dispatcher or towerman. These signals are usually mounted below an automatic block signal and are connected so as to make the block signal indicate stop unless the train-order signal shows clear. Train orders are given directly to the train crew by telephone. A similar system is used at several locations on the BMT Division of the New York City subways.

Light signals have come into use as train-order signals only in recent years, and are still rather uncommon. At new interlockings the PRR is using a flashing yellow light mounted below a position-light home signal as a train-order signal.

A SIGNAL aspect is the appearance of a signal as viewed by the engineman of a train approaching the signal, while the signal indication is the meaning conveyed to the engineer by the signal aspect.

An ideal system of signals would have one aspect, and only one, for each indication. In actual practice, there may be several different aspects which convey the same indication. This

arises principally from the various types of signals which are in use. This is not a very serious fault except that it makes it necessary for an engineman to memorize more aspects than would otherwise be necessary. What is more serious, however, is the fact that a single aspect may convey more than one indication, depending upon the particular signal which displays it. One example is the night indication red-over-yellow which might mean absolute stop; stop, then proceed; proceed at restricted speed; or proceed at slow speed prepared to stop at next signal. Fortunately, most railroads have eliminated ambiguities of this sort.

With the use of signals composed of several units each capable of displaying several aspects, it is obviously possible to obtain a large number of different signal aspects. Whereas a single-arm three-position signal displays three aspects, a two-arm signal may display nine aspects, and a three-arm signal may display as many as 27 different aspects. For any signal, the number of possible aspects is P^n, where the exponent n is the number of arms or units and P is the number of positions each unit may display. For example, a three-unit position-light signal would be capable of displaying $4^3 = 64$ different aspects. Practically, of course, no railroad requires this many aspects. In fact, the trend has been to decrease the number of different aspects in use, and the Pennsylvania Railroad uses only 15 aspects on its position-light signals, plus two special aspects, one of which is used only on the electrified lines.

Turning now to the indications, or information conveyed by these aspects, there appear to be four basic indications in modern signaling: stop, slow speed, medium speed, and full proceed. Actually there are variations of these, principally for the purpose of giving additional advance information. On pages 18 and 19 are signal indications with the corresponding aspects. This table was devised by the author to as nearly as possible consolidate American practice. Actually each railroad uses its own designations for aspects and indications. The columns of semaphores and color-lights include the aspects used by most American railroads except for those marked B&M and NYC, which are confined principally to these two roads. Details of the lower-quadrant aspects have purposely been omitted because they are gradually being superseded, and a complete tabulation of all varieties of signal aspects would fill a good-sized book.

WITHOUT modern signaling the railroads would find it hard to carry their record wartime traffic. They would find it impossible to move more than 70 trains a day on single track, as they are doing in some areas, or to make three tracks do the work of four as they do on other divisions. Without modern signals the busy four-track Eastern roads could not move trains with flexibility from one track to another, passing passenger trains around freights and fast passenger trains around slower passenger trains. Without interlockings and the multiple-aspect interlocking signals for traffic control, our busy junctions would be sorely congested messes of waiting trains. Signaling has indeed kept up with railroad progress, and, whatever tomorrow holds for the railroads, we can be sure that signal practice will be in the forefront, helping to speed service, increase safety, and cut operating costs.

Of Kent Day Coes.

The watercolor on the next two pages is of a New York, Ontario & Western freight just west of Campbell Hall, N. Y. [See "Railroad Wonderland in Southern New York, TRAINS for June, 1942.] The truss bridge in the background carries the Erie's low-grade Graham freight cutoff over NYO&W tracks. Kent Day Coes, the painter, moved from Chicago to Newton Center, Mass., in 1914 when he was four years old and already noticing engines and trains. "The big tank engines on the Boston & Albany commutation trains led me to the conviction that all steam locomotives were built to operate in either direction," he says. However, he has had ample opportunity to correct his early impressions of suburban engines, for since 1928 he has lived in Montclair, N. J., and has made daily round trips to New York, first on the Erie and later on the Lackawanna electric. Kent is a photographer as well as painter, and his wife Helen accompanies him on railroad photo expeditions. She jots down details for future reference. Kent paints from memory, trying to create some effect not possible with photography. His camera shots are referred to only to insure correctness of detail.

Mr. and Mrs. Coes.

Westbound Freight

F. C. Kauke, 1231 N. Robles Ave., Pasadena, Calif.

Up the Tehachapi.

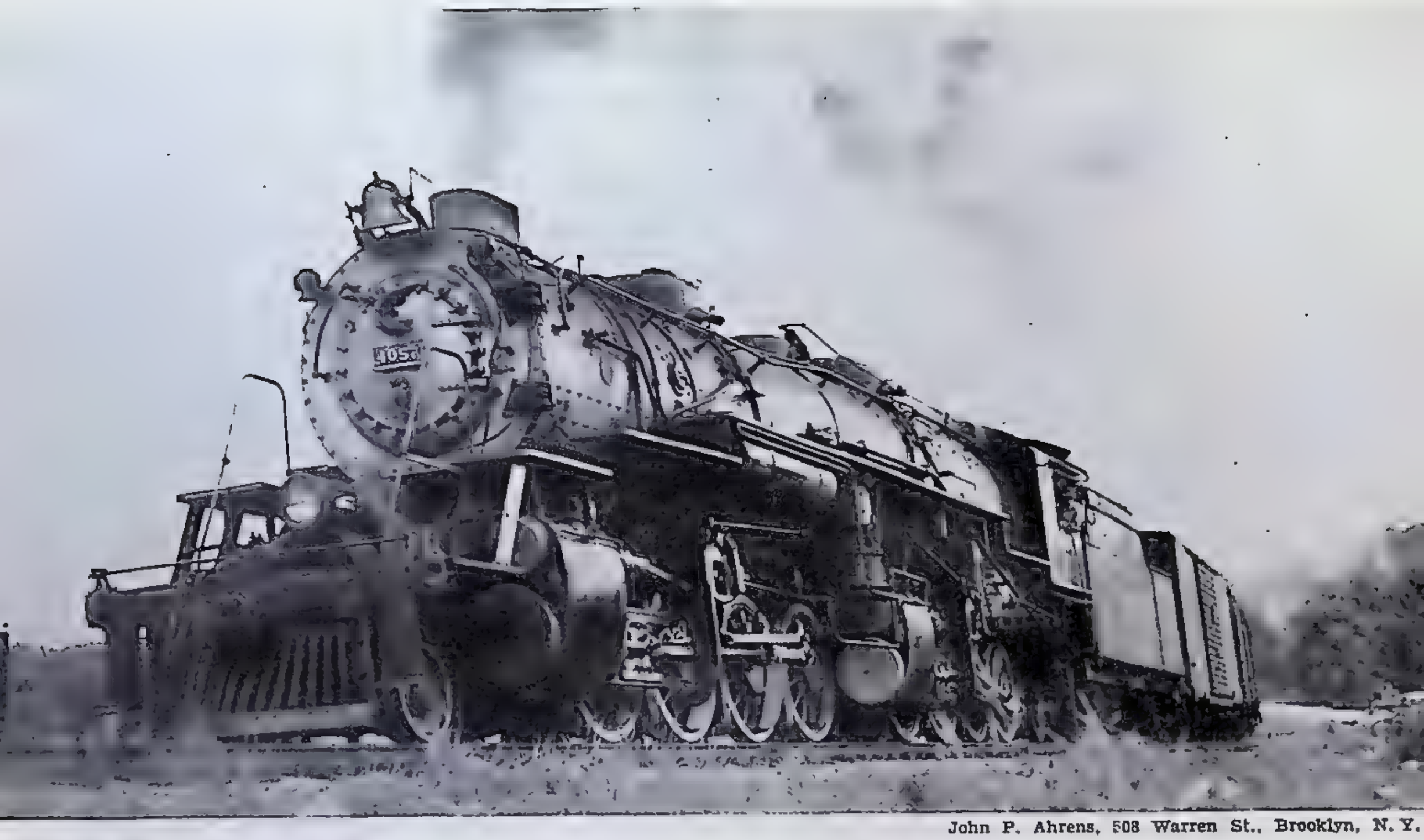
With two Santa Fe type (2-10-2) engines on the front and one on the rear, Santa Fe freight train Extra 3842 West climbs the 2.3 per cent grade west of Mohave into the Tehachapi Mountains. The line over the mountains between Mohave and Bakersfield was built by the Southern Pacific in 1876 and has been used jointly by the two roads since 1898, when the Santa Fe extended its lines into Central California. To gain the necessary elevation on the west side of the range, engineer William Hood designed the famous Tehachapi Loop which tunnels into the side of a ridge, twists around the crest of a peak, and then crosses over itself to gain 77 feet of elevation and thus bring the line into position for easy grades to the summit. This line is the original SP connection between Los Angeles and San Francisco and the present San Joaquin Valley line. The Santa Fe operates a bus connection from Los Angeles to Bakersfield, shortcutting Tehachapi and Cajon.

Slick Southern articulated.

The Southern Railway is noted for the neat appearance of its motive power, and this simple articulated locomotive swinging 'round the curve with a Spartanburg freight southbound out of Asheville, N. C., is no exception. Over this line run through trains from Charleston, S. C., to Cincinnati and Chicago. Asheville is in the highest part of the Appalachian Mountains, near 6684-foot Mount Mitchell, highest peak east of the Mississippi River. This is a popular vacation land, called "the land of the sky."

Around Cape Horn.

When the Central Pacific built up the American River Canyon in 1865 and '66, workmen were lowered in bosuns' chairs over the side of a steep cliff at one particularly treacherous place to cut a narrow ledge 2500 feet above the river. This was called Cape Horn, and for years chills ran down the spines of passengers as their trains swung around the curve with a half-mile view straight down on the outside. Now a tunnel cuts off the Horn, but this early view of a doubleheader downgrade freight about to take the dizzy turn brings back those days of dangerous railroading.



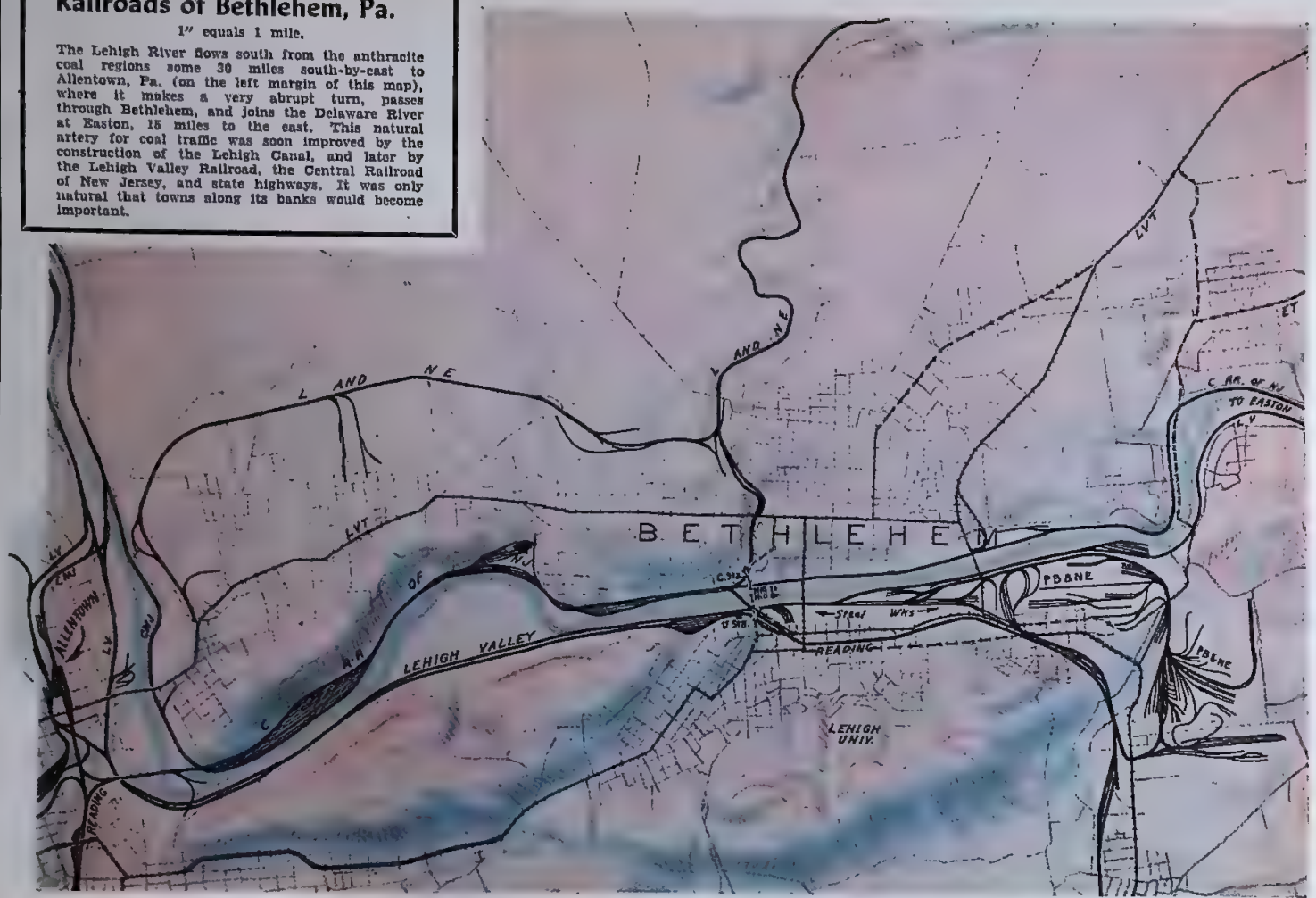
John P. Ahrens, 508 Warren St., Brooklyn, N. Y.

Courtesy Milwaukee Public Library.

Railroads of Bethlehem, Pa.

1″ equals 1 mile.

The Lehigh River flows south from the anthracite coal regions some 30 miles south-by-east to Allentown, Pa. (on the left margin of this map), where it makes a very abrupt turn, passes through Bethlehem, and joins the Delaware River at Easton, 15 miles to the east. This natural artery for coal traffic was soon improved by the construction of the Lehigh Canal, and later by the Lehigh Valley Railroad, the Central Railroad of New Jersey, and state highways. It was only natural that towns along its banks would become important.



Linn H. Westcott.

The Railroads of Bethlehem

★ Pennsylvania city of one industry and 60,000 population boasts six steam railroads.

By J. L. Schaeffer.

FEW one-industry towns of a mere 60,000 population can boast of six steam railroads to fascinate the railfan, but Bethlehem can. Few towns of this size can even find evidence remaining of streetcar days, but the Pennsylvania home of Bethlehem Steel has a healthy traction system that has absorbed equipment from a dozen other and larger communities. Bethlehem doesn't know it, but it deserves the interest of all Americans who like railroads. It can provide many entertaining hours for railroad-minded visitors.

For almost two centuries the boroughs that were to become Bethlehem struggled to straddle the gap in the valley that was the Lehigh River. There were bridges almost from the beginning, but nothing to provide real unity until the town fathers built what they called the Hill-to-Hill Bridge in 1924. The bridge is an excellent gallery from which most of Bethlehem's railroad activity may be seen, for it crosses over the Reading, the Lehigh Valley, the Lehigh & New England, and the Central Railroad of New Jersey tracks, as well as the Lehigh River and the Lehigh Canal.

The Lehigh Valley on the south, and the Central Railroad of New Jersey on the north side of the river parallel this stream all the way from Easton through Bethlehem and Allentown to points north and the Wilkes-Barre and Scranton region. The Reading, which comes overland from Philadelphia, crosses the Lehigh Valley at grade on the south side of the river and then passes over a bridge owned by the CNJ to meet the Central of New Jersey main line just west of the Hill-to-Hill Bridge. Near the south end of the bridge is the modern Union Station serving the Lehigh Valley and the Reading, while the antiquated Central Station on the opposite end serves the Central Railroad of New Jersey.

Farther east and down the river is the three-mile Philadelphia, Bethlehem & New England Railroad. Altogether there is a lot of railroading along the river.

The Lehigh is the river that brought railroads to Bethlehem. It is also responsible for the natural growth of a metropolitan area with Bethlehem as its center. Three cities with a combined population of more than 200,000 spread out almost as a single continuous city along nearly 20 miles of river.

Six miles up the river from Bethlehem is Allentown, a shopping center of 96,000. Trolleys ignore city lines and provide continuous service through both cities. Easton, 12 miles down the river, hugs the Pennsylvania-New Jersey state line and marks the point where the Lehigh flows into the Delaware River. Easton's 45,000 must be content with the half-hour high-speed trolley service that goes through Bethlehem to Allentown.

Bethlehem likes to emphasize its Star-of-Bethlehem heritage, but it scarcely recognizes the four-point star of rails that marks it on the map. Going east and west along the river banks are the roads already mentioned. From the south the Bethlehem Branch of the Reading Company recognizes the city as its terminus, but provides through service by connection with the Central and Lehigh Valley. From the north comes the little Lehigh & New England to interchange with the Central.

These are the roads the Bethlehemite recognizes. He is only vaguely aware of the bustling Philadelphia, Bethlehem & New England which the Bethlehem Steel Company operates for interchange with the "big" roads. Even if he works for the steel company he may know nothing of the narrow-gauge plant railroad or of the wide-gauge trolley line that carries ore to the blast furnaces. And he would be completely surprised to know that the Lehigh & Hudson River has trackage rights over the Central and runs an occasional freight through town.

When, in 1741, the Moravians settled in their valley, they named the spot Bethlehem because

Courtesy Lehigh & New England.

This hopper car with a roof is a Lehigh & New England bulk cement hopper car. More cement is loaded annually on the L&NE within a radius of 19 miles of Bethlehem than is loaded on the entire system of any other railroad in the United States. During recent years, beginning with the early '30's, cement loading has precipitously changed from bags in box cars to bulk loading in these special hoppers, and now more cement is loaded this way than by the old method. L&NE has 465 covered cement hoppers.

it was so peaceful on that Christmas Eve. They didn't know about the low-grade iron ore in the hills above the town, ore that would later be fed into tiny charcoal furnaces to make cannon balls for revolutionary soldiers. They didn't know that limestone, just right for ironmaking, lay all around them. They didn't know that the very water of the river would be the raw material used in greatest quantities by the steel mill that would sprawl along the river. No suggestion of teeming train traffic, of an industrially overgrown city, lay in the original Bethlehem.

These Bethlehem fathers were not industrialists; they were peace-loving farmers who wanted the freedom to worship as they pleased. They were content to live their communal life with scarcely a thought of the developing country around them. But there was no way of ignoring the canal which had to follow the river and had to come through Bethlehem.

At first the river itself was used. Rough wooden arks were constructed at Mauch Chunk and loaded with coal. They were floated down to Philadelphia, where the arks were broken apart and sold for lumber. This system was operated none too successfully from 1819 until 1838, when the canal was completed.

Oddly enough, the canal had an important part in the building of the two of Bethlehem's railroads that were later to make the canal unprofitable to operate. The first, the Lehigh Valley, was built by a canal boatman who saw the advantages of the railway system. The other, the old Lehigh & Susquehanna, was started by the Lehigh Coal & Navigation Company when its canal was washed out by floods above Mauch Chunk.

Let's consider the Lehigh Valley first.

Bethlehem newspapermen like to refer to Asa Packer as the "Connecticut Yankee in the Court of King Anthracite." Asa Packer wanted to speed up the shipment of coal. It was he who chartered the Delaware, Lehigh, Schuylkill & Susquehanna Railroad that never ran a train . . . who finally built a double-track line from Mauch Chunk to the Delaware River.

From the beginning, the Lehigh Valley was Bethlehem's railroad. Its first train on September 12, 1855, was Bethlehem's first. Its first crack train, the *Black Diamond,* has always represented the de luxe in railroading to Bethlehemites. Its home office is in Bethlehem.

Today the Lehigh Valley operates a four-track main line through Bethlehem. A familiar sight is the solid train of hopper cars laden with iron ore for Bethlehem Steel. Outgoing trains pull gondolas of finished bars and structural steel, flat cars loaded with heavy forgings and box cars containing finer steels and small forgings. To take care of Bethlehem Steel shipments the "Valley" operates two freight yards in the city, one at each end of the plant. These yards are interchange points for Reading and PB&NE traffic. One, the Calypso Yard, was built by digging up a small island and dumping the fill into the river channel.

Pride of the "Valley" until the flood of last year was the well manicured roadbed that earned the praise of Lucius Beebe. Bethlehem Steel rail rests on mathematically spaced ties cut to exact length. The trackage is ballasted with almost-white limestone, and prewar track crews kept the edges in perfect alinement.

Sacred tradition of the "Valley" is the *Black*

Diamond express. Advertising dated 1900 shows a four-car train pulled by a high-wheel Atlantic. A combination express-cafe car, two coaches and a Pullman made up the train. "Vestibule Trains Heated by Steam," "Lighted by Pintsch Gas," "Dining Cars a la Carte," the advertisement proclaims. By the time of the first World War the *Diamond* had graduated to a light Pacific and was the subject of an oil painting that was reproduced surprisingly well and presented —complete with gilt frame—to influential customers. Later they were given to employees who bought their quota of Liberty Bonds. A number can still be found in Y. M. C. A. reading rooms, especially in the coal regions.

Oddly enough, it was not the *Diamond* that was first streamlined by the Lehigh Valley. A new train, the *Asa Packer*, was scheduled for the Mauch Chunk-New York run. A New York designer planned the rebuilding of equipment in "Valley" shops and turned out a striking creation in orange and black. It was never too well liked, and when he later designed the *John Wilkes* in red and black the *Asa Packer* was restyled in the same colors. The *Black Diamond* was third in line, and today most of the "Valley" passenger cars are repainted in the same colors.

While under construction, the old Lehigh & Susquehanna was known as "The Lehigh Coal & Navigation Company's Railroad"—quite a title for a simple canal extension. Built originally from Mauch Chunk to Easton, the line ran its first train through Bethlehem on November 29, 1867. While the road was extending its trackage to Scranton the New Jersey Central was working its way from the Jersey side of the Hudson to Phillipsburg, N. J., just across the river from Easton. In 1871 it absorbed the Lehigh & Susquehanna, and two years later built the passenger station in Bethlehem that is still in use today. As it stands, the Central Railroad of New Jersey is the result of the absorption, directly or indirectly, of 48 different roads.

The Central used to be a road of short trains. Consolidations and Mikados would pull trains of seldom more than 30 cars, but war traffic has now almost doubled the average. Heaviest Bethlehem industry served directly by the Central is a small steel-fabricating plant. Building supplies, coal, grain, bulk cement, and even graphite are delivered to other dead-end sidings. Of special interest is the "above-water" siding where hopper cars of coal are spotted for a distributor who once received all his shipments by canal boat.

The excellent grooming of Central motive power is particularly evident in passenger service, with light Pacifics doing most of the hauling. Responsibility for their condition is assumed at the modern engine terminal the Central carved out of the side of a hill just below Bethlehem's snootiest residential district. That was as recently as 1924, and only a few of the residents have since moved away. The roundhouse facilities are now shared by the Reading.

The Central has always provided conservatively good passenger service. There were never any extra-service trains until the late 1920's, when a bright blue train had its first run under the name of *The Bullet*. It was never too much of a success in Bethlehem, where loyal supporters of the *Black Diamond* referred to it contemptuously as *The Blank Cartridge*.

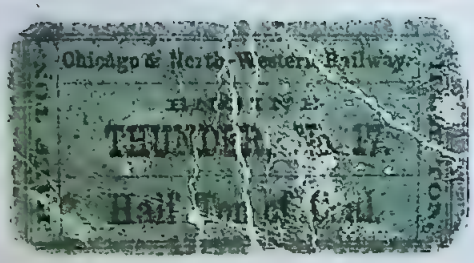
In order to provide through service to Philadelphia, the Central has to cross the river and the Lehigh Valley tracks to join the Reading line. The Reading uses the same crossing and Central trackage to join its own facilities at Allentown. It was this grade crossing that was responsible for Bethlehem's only serious rail accident when, in 1926, Lehigh Valley and Jersey Central trains came together in a crash that killed eight passengers and one of the train crew, and injured 40 others.

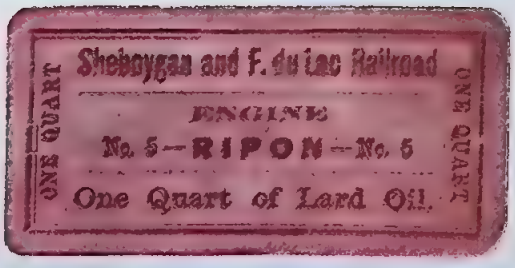
The Central was the first railroad to use the electrically operated semaphore. The invention

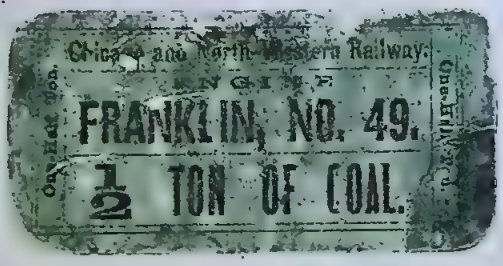
Railroads of Bethlehem.

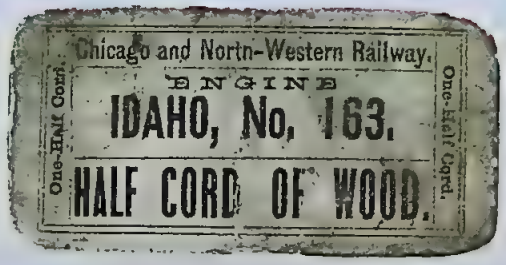
	Miles	Locomotives	Cars: Freight	Cars: Passenger	Cars: Misc.
Reading Company	1379	683 (28 oil-elec.)	32,651	785 (16 motor)	884
*Lehigh Valley	1262	382 (35 oil-elec.) (5 gas-elec.)	16,343	320	610
Central of New Jersey	661	390 (21 Diesel)	11,792	623	159
Lehigh & New England	190	46	3,342	—	38
Lehigh & Hudson River	96	17	124	—	46
Philadelphia, Bethlehem & New England	55	28 (20 oil-elec.)	—	—	—

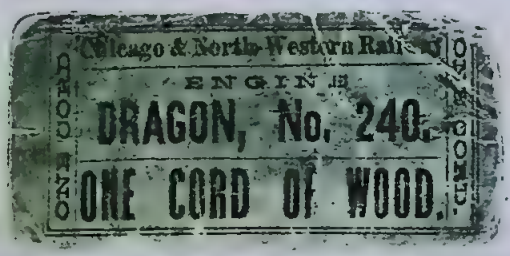
* On order, 31 Diesels, 10 class T-2 steam locomotives, 500 composite-type coal cars (Figures taken from *Pocket List*, first quarter, 1943.)











Tickets courtesy F. A. Cole, 419 Cottage Ave., Glen Ellyn, Ill.

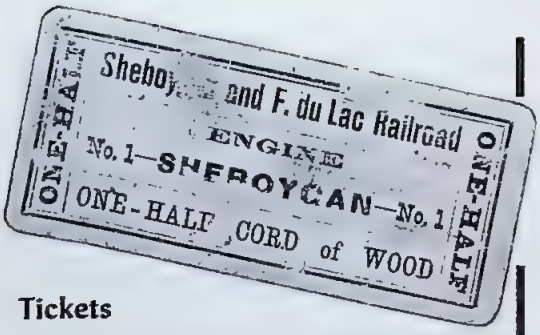
of a Bethlehem man, J. W. Lattig, it was first installed in 1883 at Black Dan's Cut, about 15 miles east of Bethlehem.

In any discussion of the Jersey Central's facilities in Bethlehem, the name Reading is bound to appear frequently. Besides sharing right of way, both railroads are partial to similar motive power. The wide firebox that is so characteristic of Reading locomotives is almost as wide on the Central. Neither road has yet eliminated the hunchback of the rails, the Mother Hubbard (or Camelback, as it is called locally). Many are still in use here for switching service. Most apparent difference is the Central's partiality to feedwater heaters in front of the smoke stack, a feature absent in Reading design.

That the largest railroad running through Bethlehem is the Reading is not immediately apparent, for the line that serves the city is only a branch of the main road. From Philadelphia to Bethlehem the two tracks hum with a constant stream of traffic. While other local roads are strictly semaphore-conscious, the Reading uses quaint banjo signals to regulate train movements. While the others enjoy almost complete freedom from grade crossings, the Reading passes through the most congested part of town and has to maintain gates and watchmen at 12 places along a mile run. Here it is so crowded that many of the watchmen's shanties perch stork-like above the ground.

Chartered in 1852 as the Philadelphia, Easton & Water Gap Railroad Company, the name was changed to the North Pennsylvania Railroad shortly after construction was begun. From July 1, 1857, when the first train was run to Bethlehem, until 1879, when the road was leased by the Philadelphia & Reading, it was known as the North Penn.

Today in Bethlehem it is still called the Philadelphia & Reading, for the financial readjust-



Tickets for locomotive fuel.

Back in the 1860's, when locomotive tenders were small and backs were strong, railroads furnished their enginemen with fuel checks so they could load wood or coal along the line if they ran low. The Sheboygan & Fond du Lac (now part of the C&NW in Wisconsin) engineer of that time, cruising along west of Plymouth, might find himself about to run out of fuel, so he'd stop at a farm and exchange a ticket for one-half cord of wood, enough to bring him into Fond du Lac. The farmer would then cash the ticket with the railroad management, and the fuel would be charged to the operating expenses of the appropriate locomotive as indicated on the ticket. On some roads similar tickets were used as a means of accounting for fuel and supplies drawn from engine terminals. Of particular interest are the colorful locomotive names, and that the C&NW was apparently in the midst of converting to coal.

ment and mergers that created the Reading Company took place in the late 1920's. With its 30,000 freight cars in service, the Reading is undisputed No. 1 carrier of anthracite coal.

But the bulk of the flow of anthracite misses Bethlehem. Here the railroad carried a mixed lading gathered mostly by interchange with other Bethlehem railroads. A part of every train are the reefers the Lehigh Valley drops off on their way to Philadelphia. In fact, it is not at all unusual to see a couple of MDT's tacked to the end of a local passenger train.

Passenger service on the Bethlehem branch of the Reading is mostly local. Frequent trains are heavily loaded and indispensable for commuters from the suburban towns that line the tracks to Philadelphia. Pullman service is usually that of the Philadelphia-bound cars of the Lehigh Valley and Central, but the Reading does run through trains such as the one from Philadelphia to Binghamton, N. Y. Reading equipment travels Lackawanna, Jersey Central, and its own trackage to make this run.

And that, except for the transit system, completes the roster of passenger-handling railroads of Bethlehem. The others carry nothing but freight and cannot even claim ownership of a single piece of varnish.

The Lehigh and New England is probably the most prosperous of the Bethlehem railroads. Its main office is in Bethlehem and stands beside the larger office of the Lehigh Valley. Although it now carries no passengers, there was a time when the road offered almost the only service south from the New England states. The slow death of this service was probably responsible for the inevitable corruption of L&NE to "Late & Never Early" in local minds. Tradition has it that on this railroad was operated the original "5:15"—a myth that gained considerable weight because of the operation of a train that could usually be expected to blow for a local crossing at 5:15 each afternoon.

The Lehigh & New England, formerly the Lehigh & Lackawanna, formerly the Bethlehem Railroad, was chartered in 1861. Taking advantage of the peculiar geography of the region that provided "belts" of commercially important rock to the north of Bethlehem, the railroad was able to tap the cement-producing region, the slate belt, and finally the fringes of anthracite production. But it is for cement-hauling that the road is best known.

Back in the days when it was first thought that a bag of cement was too small for large-scale production, the Lehigh & New England built its first covered hopper cars. She didn't make the mistake of attempting to convert standard hoppers, but instead built them of a new design with hoppers that sloped more steeply than in coal cars. Today, wherever bulk cement is used in the Eastern states, the red and black herald of the L&NE is almost certain to be represented among the gray cars.

The Lehigh & Hudson River Railroad is the one Bethlehem road with no trackage in the city. It must be mentioned, however, because of the occasional train that passes over Central tracks. These can be identified at almost any distance by the wooden cabs perched on the tenders of L&HR locomotives. Although this is standard practice on freight engines of a number of railroads, there are no other tender cabs operated in the vicinity of Bethlehem.

J. L. Schaeffer.

All aboard!

Lehigh Valley side of Bethlehem Union Station with the Hill-to-Hill Bridge in the background. Below, a Jersey Central engine gets a hot oil (with steam) treatment at the Bethlehem engine terminal.

J. L. Schaeffer.

SOLE listed assets of the Philadelphia, Bethlehem & New England are 28 locomotives and 55 miles of track in a three-mile area around the plant of Bethlehem Steel. Actually there is much more of interest in the variety of rolling stock owned by the steel company, and in the minor rail lines operated by the plant.

The PB&NE takes care of only the standard-gauge track in the plant. Diesel-minded, the company operates a locomotive repair shop fed by a transfer table. Neither the oil-electrics nor the few 0-8-0's and 0-6-0's need to be turned around for their short runs, but when this becomes necessary for repair work the ends can be reversed on wye tracks. Stationary car-pullers of the cable type supplement the motive power at some points. In one series of shops where a great deal of switching is done under roof, two "canned steam" 0-4-0's are in continuous service.

Then there is an extensive narrow-gauge road that is used for hauling ingots out of the open hearths. Most of the trackage is laid along with the standard gauge and gives the effect of an inside third rail. All the locomotives here are 0-4-0 Diesels which have gradually taken the place of the more picturesque saddle-tank switchers.

Most unusual is the wide-gauge electric trolley line that carries ore to the blast furnaces. A rotary car dumper can drop ore from standard hopper cars into the trolley hoppers, or two huge gantry cranes can load them from stock piles.

Still another trolley line (standard-gauge this time) is used to shuttle raw materials to the "skip hoists" where inclined-plane railroads carry coke, ore and stone to the tops of the blast furnaces.

Rolling stock in the plant is of particular interest. Besides the usual box cars, there are high-side hopper cars for carrying full loads of light coke; ladle cars to take molten slag to the cinder dump; hot-metal cars called "submarines" because of their shape. A scale test car completes the inventory.

BETHLEHEM was last of the Lehigh Valley communities to have streetcar service. Horse cars were running in neighboring Allentown in the late '60's, but it was not until August 1, 1891, that the first trolley was run in Bethlehem. Operated by the Allentown & Bethlehem Rapid Transit Company, the line was an extension

from Allentown. Although Bethlehem had a late start, the next 10 years were sufficiently hectic to make up for any lost time.

In the first place there were almost a dozen transit companies and would-be companies involved in the struggle. To make matters worse, Bethlehem at that time consisted of four separate boroughs, and each had a personal feud with a different transit company. Typical of the borough politics was the agreement giving "a right of way at four miles per hour, with a five-cent fare, and the chief engineer of the fire department, all policemen and the street supervisor being given free rides." Two weeks later the agreement was canceled.

Unable to reach definite agreements with borough councilmen, the transit companies began the practice of laying tracks and tearing them up at will. One company even laid unauthorized double tracks on a main street without protest from anyone but the local newspaper, which editorialized indignantly and without effect. Another company, wanting to remove tracks from an important intersection, sent a crew to start work at the break of dawn. Unfortunately, the councilman in charge of streets was on his way home at a very early hour. He sent a policeman who was able to stop proceedings.

Toward the end of the decade one company began a policy of appeasement. Even the newspaper began to approve. Where some desirable streets had been occupied successively by as many as three different lines, more and more of them were being taken over by the Lehigh Valley Traction Company. Finally, in 1905, the entire system of the four boroughs was consolidated as the Lehigh Valley Transit Company.

Most of the streetcar lines that caused so much excitement have long since been torn up or abandoned. All of the country lines to smaller neighboring towns have been replaced by bus service. There remain only the heavily traveled routes through and across town and the high-speed service between Allentown, Bethlehem and Easton. Not much compared to the former maze of tracks, but still one of the few remaining trolley systems outside of the big cities. And the important business of carrying war workers has given it a new lease on life. All available equipment is kept busy night and day as staggered shifts maintain a constant flow of men and women to and from the plant.

And that's just about everything in Bethlehem railroads.

J. L. Schaeffer.

No smoke, no nuisance.

Pride of a railroad publicity man might be this action shot of a Reading Mother Hubbard locomotive making up a train on a stretch of main line near Bethlehem.

Expressing it mildly.

An Austin (Tex.) firm wanted a consignment of limburger cheese in a hurry, and decided to have it expressed in a long box, as a corpse. A man was sent along, of course, but remained in the coach, going forward at different stations to look after his charge. At first, the express messenger seemed sympathetic, and asked the man in a solicitous voice, "Your wife?"

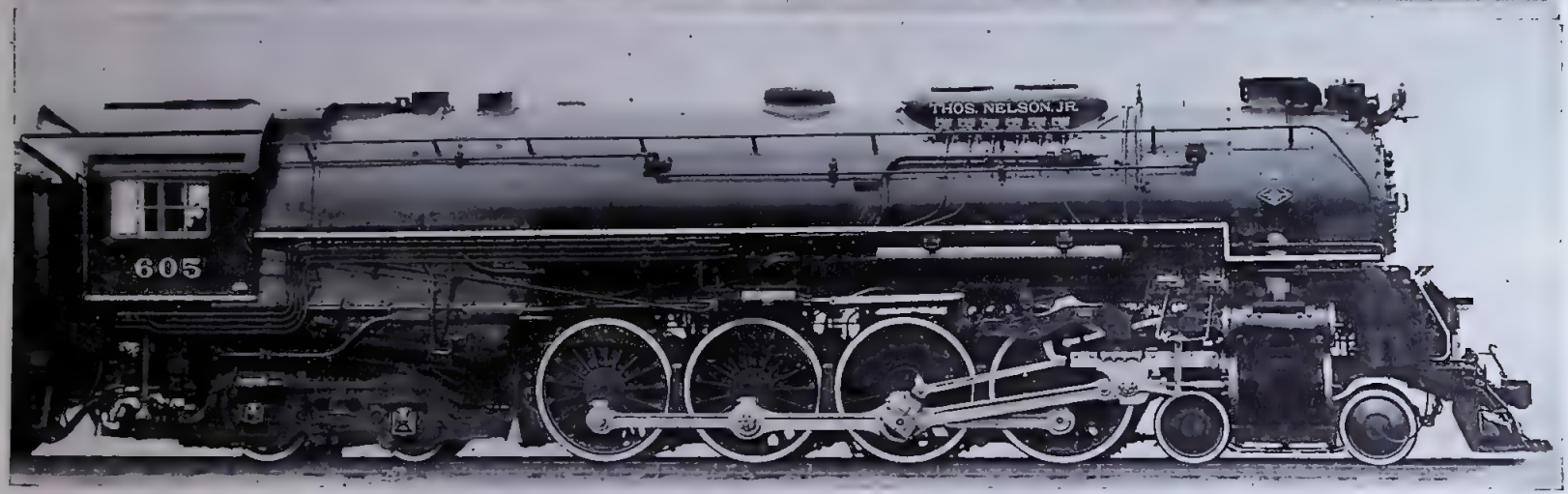
"No," responded the man, reservedly.

At the next station the messenger queried, "Mother?"

"No," said the man, and vouchsafed no further information.

As the day grew hotter and the sun beat down on the express car, the position of the messenger grew extremely unpleasant, to say the least, but he still maintained his polite manners whenever the supposed relation of the "corpse" appeared. At another station he asked, "Brother?" and was given the noncommittal negative again. Finally, when the odor had become almost unbearable, he saw the man once more.

"Say, pardner, it's a cinch this friend of yours is dead, all right," he exploded.



Older and newer C&O 4-8-4's, above. Below is one of the new 4-6-4's in use west of Hinton, W. Va.

C&O Brothers

★ Slight changes in design on new 4-8-4's.

Specifications, 4-8-4 classes J-3 and J-3a.

	J-3	J-3a
Road numbers	600-604	605-606
Tractive force, main cylinders	66,960 lbs.	68,300 lbs.
Tractive force with booster	81,035 lbs.	82,700 lbs.
Cylinders, diameter and stroke	27½" x 30"	27½" x 30"
Drivers, diameter	72"	72"
Weight on drivers	273,000 lbs.	290,000 lbs.
Total weight of engine	477,000 lbs.	503,500 lbs.
Steam pressure	250 lbs.	255 lbs.
Grate area	100.0 sq. ft.	100.3 sq. ft.
Heating surface (evaporative)	5538 sq. ft.	5494 sq. ft.
Tender capacity, both classes	Coal, 25 tons; water, 22,000 gals.	

THE designing of each new order of steam locomotives is a separate engineering job, with every detail worked out specifically to fit the job at hand. The reason for this was brought home forcibly 25 years ago when the government built standard locomotives of various wheel arrangements and assigned them to any and all railroads needing more power. They just did not do the trick. The steam locomotive is sensitive to varying conditions of fuel, water, size restriction, and operating practice, so a good locomotive on one road may be much less efficient on another road.

After the last war hundreds of U. S. R. A. locomotives were more or less rebuilt to fit the owner roads better, and have been turning in creditable performances ever since.

The latest Chesapeake & Ohio 4-8-4 type, Class J-3a, locomotives are another illustration of why locomotives, even for the same railroad, are not turned out on a production basis. The new *Thomas Nelson Jr.* and the *James Monroe* are mighty like their older brothers, *Thomas Jefferson, Patrick Henry, Benjamin Harrison, James Madison,* and *Edward Randolph,* but study of the specifications will show slight differences.

A railroad doesn't just order "another two like the last batch." The price of locomotives might be a little less with quantity production of stock models, but the first cost is only a small item with a machine which may turn in five million miles and burn coal worth more than 10 times its own cost. So when the C&O ordered the two additional 4-8-4's about two years ago the specifications were changed to take advantage of every small bit of experience in the operating and testing of the original 4-8-4's.

The most apparent differences between the two designs (the earlier one is the upper photo above and the later one, which has an identical tender, is the lower photo) are in the arrangements of the exteriors. The headlight, for instance, has moved down from the smokebox front to the pilot beam and the sand box and steam dome have exchanged places. The C&O has apparently found the low headlight position more satisfactory, for it is also used on other new locomotives such as the eight new Hudsons (photo below) and the 2-6-6-6 Allegheny type [March 1942 TRAINS]. The changing of the sand dome and steam dome is also a matter of experience, rather than chance, for notice that the same positioning is also used on the 4-6-4's, built by Baldwin at the same time Lima was building the 605 and the 606. Both newer engine designs use Baker valve gear, while the older 4-8-4's have Walschaert gear.

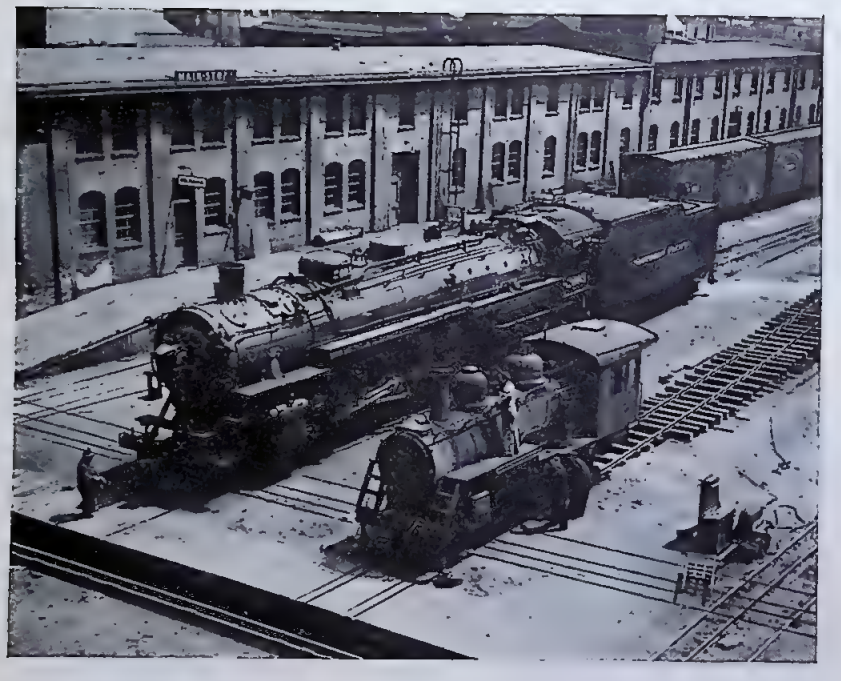
But when one gets down to such statistics as weight, grate area, heating surface, tractive effort, and so on, many a slight change can be found between the J-3's and the J-3a's—petty refinements which tempt the layman to ask, "Those changes are so small, why not leave the design the same and cut production costs by using the same specifications, jigs, and patterns? Even the blueprints must cost a mint of money, so why do 'em over?"

That five extra pounds of boiler pressure, which means practically redesigning the boiler, may mean thousands of dollars' less coal over the years. And the slightly higher ratio of grate area to heating surface indicates that the combustion rate was a bit too high on the earlier engines. The modern tendency is not only toward slower combustion rates on larger grate areas, but also toward more combustion space so that the fuel can be more completely burned before it starts through the flues.

These locomotives, regardless of differences in detail and in wheel arrangement, are clearly brothers. Notice how many of the 4-8-4 characteristics are repeated in the 4-6-4. But notice also how the 4-6-4 shows the ancestry of its builder, Baldwin, just as the 4-8-4's are unmistakably Limas.

Specifications, 4-6-4 class L-2:

Road numbers	300-307
Tractive force	52,000 lbs.
Cylinders, diameter and stroke	25" x 30"
Drivers, diameter	78"
Weight on drivers	217,500 lbs.
Weight on front truck	93,500 lbs.
Weight on trailing truck	128,500 lbs.
Total weight of engine	439,500 lbs.
Total weight of engine and tender	832,500 lbs.
Steam pressure	255 lbs.
Grate area	90 sq. ft.
Heating surface (evaporative)	4233 sq. ft.
Tender capacity	Coal, 30 tons; water, 21,000 gals.



The shop superintendent obligingly spotted a newly shopped 2600-series passenger engine on an adjoining track for purposes of contrast when Hack Miller, staff photographer for the Seattle Post-Intelligencer, made this picture. No. 10, already on jacks, has very little more power than the booster engine on No. 2603.

In the Army Now

★ Even if they're not physically up to par, old narrow-gauge engines don't escape the draft; they're hospitalized.

By Doug Welch.

THE South Tacoma (Wash.) shops of the Northern Pacific Railway, which the NP fondly claims are the largest in the United States west of the Mississippi River, are rehabilitating for the army much of the motive power of the narrow-gauge White Pass & Yukon Route [TRAINS, September, 1942], which the army is now operating between Skagway, Alaska, and Whitehorse, Yukon Territory, as a supply line to the Alcan military highway.

One of the engines being rehabilitated is No. 10, otherwise known as *Patricia*, who was taken to Seattle in the hold of a ship, loaded on a flat car and hauled over standard-gauge tracks to South Tacoma. There she was lowered by cable down a ramp to the transfer table at the shops, where she is undergoing a complete overhaul. *Patricia* is a venerable old lady, having spent much of her youth and middle age on the East Tennessee & Western North Carolina Railway [TRAINS, December, 1942] before going to the White Pass & Yukon.

In order to handle these small locomotives the Northern Pacific had to lay a third rail on its transfer table and another third rail about a hundred feet long beside the ramp for testing purposes. Shop Superintendent H. J. McLain says the little fellows are great favorites, and the hundred-foot test runs are always attended by a large and enthusiastic gallery of mechanics. The overhauling of them, however, poses many difficult problems because new parts must be machined without benefit of blueprints. "We only have the old parts to go by," McLain says. "As a matter of fact, what we really do is jack up the bell and build a new locomotive under it. When they leave here they are better engines than they were originally. They'll do everything but sit up on their hind drivers and bark."

FIRE POWER *for the home front*

AMERICA is pouring out war materials with every sinew of her industrial strength.

Planes, tanks, guns and ammunition are flowing in an endless stream to widespread fronts.

To keep it up takes power. Power takes heat. Heat takes fuel.

So together with all the food, war goods and other things the railroads have to carry, they must haul extra quantities of fuel to keep the round-the-clock plants humming

— a million barrels of oil a day to the East alone—over 100 times the amount the railroads used to bring in

— nearly 12½ million tons of coal a week — up 37% since the war began in 1939.

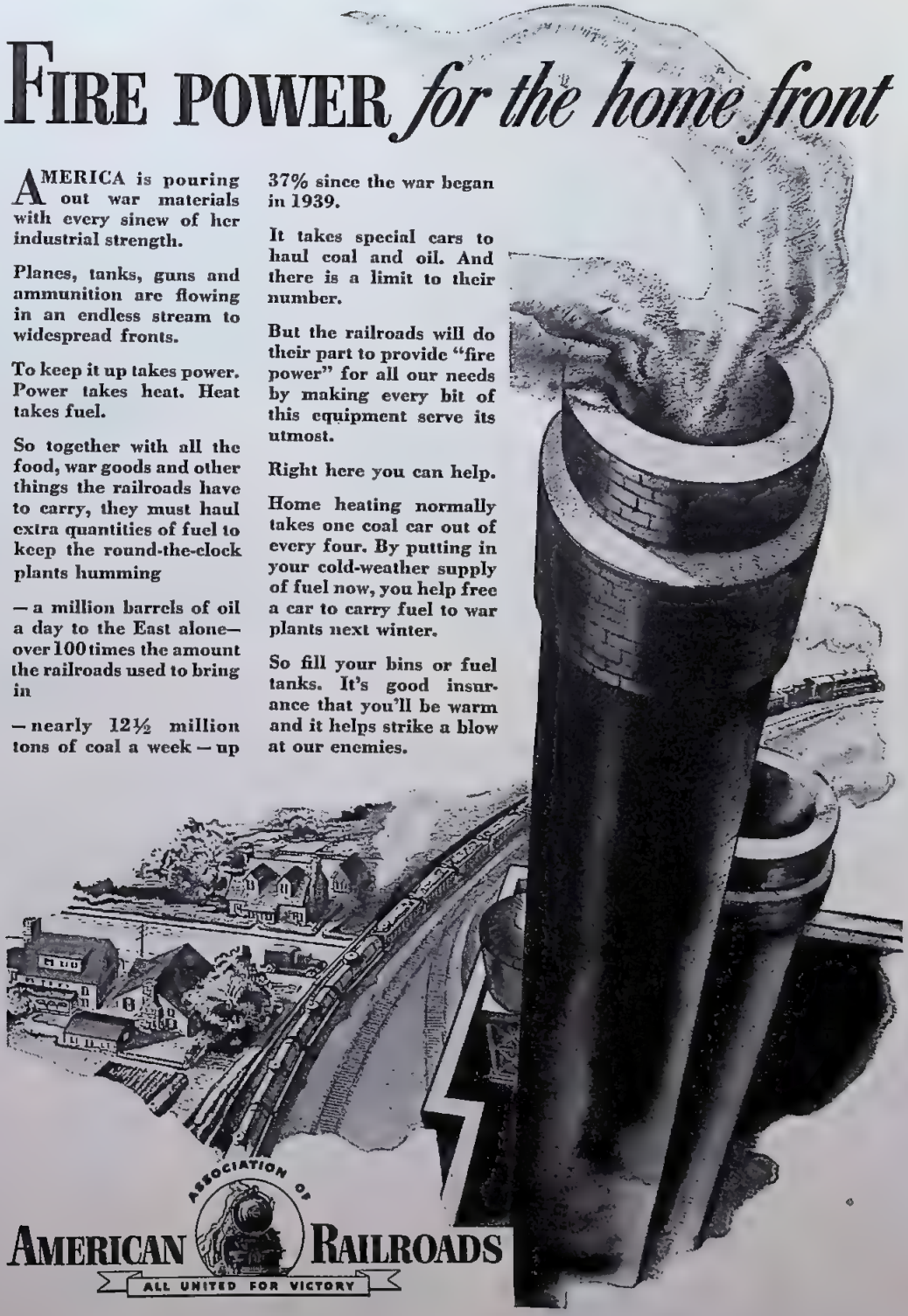
It takes special cars to haul coal and oil. And there is a limit to their number.

But the railroads will do their part to provide "fire power" for all our needs by making every bit of this equipment serve its utmost.

Right here you can help.

Home heating normally takes one coal car out of every four. By putting in your cold-weather supply of fuel now, you help free a car to carry fuel to war plants next winter.

So fill your bins or fuel tanks. It's good insurance that you'll be warm and it helps strike a blow at our enemies.



ASSOCIATION OF AMERICAN RAILROADS

ALL UNITED FOR VICTORY

Pennsylvania, Poughkeepsie & Boston 4-4-0.

Typical of the motive power of the PP&B was this 40-ton Rogers-built standard, vintage of 1889, with 18" x 24" cylinders, 62" drivers, 140-pound steam pressure, and 27 square feet of grate area. The PP&B, since a reorganization in 1895, has been the Lehigh & New England, a route from the Pennsylvania hard-coal regions toward the Poughkeepsie gateway to New England. In the early 1890's it represented the New England ambitions of the Philadelphia & Reading, which built up a far-flung system of some 2300 miles, including the present Central of New Jersey and Lehigh Valley, only to have the entire structure fall apart in the depression of 1893.

Locomotive Building Program

FIVE hundred and thirty-six new steam locomotives have been authorized by the War Production Board for delivery before June, 1944. Of these, more than 100 are already in service; the Pennsylvania Railroad alone has more than 70 of its new 2-10-4 type [June TRAINS] in operation. Pennsy and the Norfolk & Western are building their own engines; the balance are under construction by Lima, American, and Baldwin. Besides the steam locomotives listed below, 450 Diesel-electrics are authorized for delivery by March—85 freight engines of 5400 horsepower, 10 of 2000 horsepower, and the balance of 1000 and 660 horsepower for road and switching service.

Name of Railroad	Type	Number
Atchison, Topeka & Santa Fe	4-8-4	30
	2-10-4	20
Baltimore & Ohio	2-8-8-4	20
Bessemer & Lake Erie	2-10-4	10
Central of Georgia	4-8-4	8
Chesapeake & Ohio	2-8-4	40
	2-6-6-6	10
	0-8-0	10
Chicago, Rock Island & Pacific	4-8-4	10
Detroit, Toledo & Ironton	2-8-2	4
Indianapolis Union	0-8-0	3
Lehigh & Hudson River	4-8-2	3
Lehigh Valley	4-8-4	10
Missouri Pacific	4 8-4	15
Nashville, Chattanooga & St. Louis	4-8-4	10
New York Central	4-8-2	25
New York, Chicago & St. Louis	2-8-4	15
Norfolk & Western	2 6-6-4	25
	4-8-4	6
Pennsylvania	2-10-4	150
Pere Marquette	2-8-4	12
Pittsburgh & Lake Erie	0-8-0	28
St. Louis-San Francisco	4-8-4	10
Southern Pacific	4-8-8-2	20
	4-8-4	10
Union	0-6-0	10
Union Pacific	4-6-6-4	25

Railroadiana

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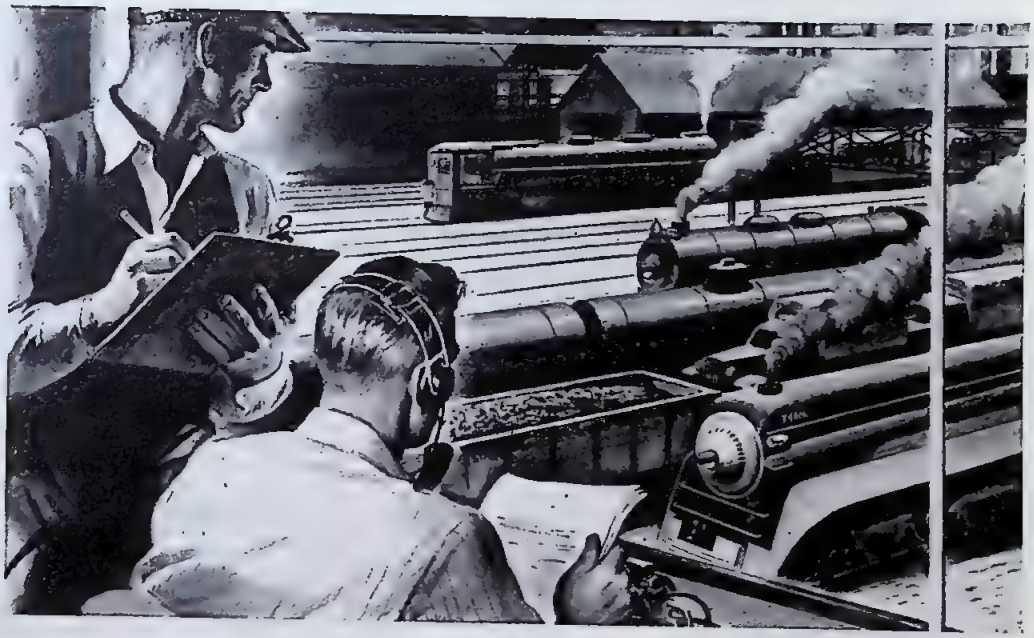
WHAT do you know about your favorite railroad? We both sell and buy out-of-print books and rare items in Railroadiana. Send for our latest list.

GRAHAME HARDY

538 - 15th St.
Oakland, Calif.



Buy War Bonds for Victory!

"Lend-Lease" among the Railroads

For months before Pearl Harbor, as America rearmed, U. S. railroads carried a heavy traffic load. This load grew to unprecedented size when war came. Day and night the troop trains and the war freights rolled!

To Southern Pacific, western pioneer with more miles of line than any other U. S. carrier, was entrusted great responsibility. And every day since Pearl Harbor the pressure of war has mounted on the railroad.

From Chicago, from New Orleans, and from the Pacific Northwest, S. P.'s transcontinental lines converge at West Coast ports where troops and war equipment are massed for action in the Pacific.

All along our great network of rails, a stepped-up production of war materials is flowing to all war theaters.

Through the lean years of 1930 to 1941 we spent more than 195 million dollars for new equipment, additions and improvements. In the two-year period before Pearl Harbor, we ordered 64 million dollars' worth of cars and locomotives alone!

But no amount of foresight could make us fully equal to the war load. Some of our locomotives were still undelivered. We needed more.

Other U. S. railroads recognized the nation's need to make full use of S. P.'s strategic western track, and they agreed to rent us some of their locomotives.

One of our competitors furnished us with six locomotives. During one period in 1942 a total of twenty-seven locomotives "lend-leased" by other lines saw service with S. P.—helped us keep the war trains rolling at a record clip. In our turn, of course, we are doing all we can to cooperate with other lines.

Today the railroads are applying the "lend-lease" spirit to many wartime operating and traffic problems.

If another road is better able to handle a certain job, we turn it over to them (and they get the revenue involved). And other roads divert traffic to us when they are hard-pressed.

S. P. is proud to work with all the other railroads in this war. *Working with this team of giants, we know we work toward Victory!*

A. T. MERCIER, *President*

S·P

The friendly Southern Pacific

Headquarters: San Francisco

One of America's railroads—all united for Victory!

The Man in the Tower

By Edward Hungerford.

A RECENT trip through some of the states of the North and East gave the Towerman a fair indication of the state of affairs on the railroads at just this moment. Bewildering statistics of the highly competent job that they are doing at the moment constantly are being published. Washington solemnly warns passengers off the cars, and at the same time shuts off gasoline supplies to civilians, and horrendous tales are being told of the difficulties that travelers are beginning to encounter on trains. Why—just think of it—on some of the roads in the Far West and Southwest only *two* meals a day are being served in the dining cars!

The Man in the Tower went first to New York . . . then to Chicago and to St. Paul . . . back to New England . . . finally to Baltimore and to Washington and back again to his own Tower in this pleasant western New York country. He rode on a good many trains, on a good many railroads, and found none of them overcrowded. On an early-morning train on the Pennsylvania from New York to Philadelphia, there were a few standees, but all of these had disappeared by the time we had left Newark. . . . The Towerman even risked the main line of the busy New York Central from Syracuse to Rochester in the evening of July 5—the end of a three-day holiday that had been dreaded by the railroads and which really amounted to nothing at all. There were seats in all of the coaches of that train.

Perhaps the fact that the Man in the Tower is never without his crutches may have had something to do with it, but never was he compelled for one moment to stand in a train—nor was anyone else that he could see. There were always (with that one exception) seats for all at all times. Some of the time the trains were hardly more than half filled. Two or three times, Pullman sleepers had only half a dozen berths taken. And, with three exceptions, there was no waiting for a seat in the dining car. This was the Towerman's personal experience on something over 6000 miles of travel. He came to the conclusion that there was a good deal of buncombe in those statements being handed out from Washington.

Of course, down in the Deep South, the Southwest and the Far West he might have found things far different. Those areas never have been too heavily railroaded. And the roads that serve them never have been too generous with their passenger service . . . with the result that, caught in the present situation where they are unable to add trains to their schedules, some of them are having a hard time of it indeed, in taking any proper care of their patrons. This situation apparently does not apply in the North and East.

THE Man in The Tower rode many railroads—many trains . . . the *Black Diamond* of the Lehigh Valley . . . the crack day trains on the Erie and the Lackawanna . . . the *Congressional* of the Pennsylvania . . . the New Haven's *Comet* . . . the *Alouette* on the combined service of the Boston & Maine and the Canadian Pacific between Boston and Montreal . . . that grand old gal, the *Twentieth Century Limited* of the New York Central . . . the *Royal Blue* of the Baltimore & Ohio . . . the "*400*," the *Hiawatha* and the *Zephyr* that ply daily between Chicago and the Twin Cities. Not one of these trains did he find uncomfortably crowded—uncomfortable in any way. Some of them were more comfortable than others. But none of them was bad.

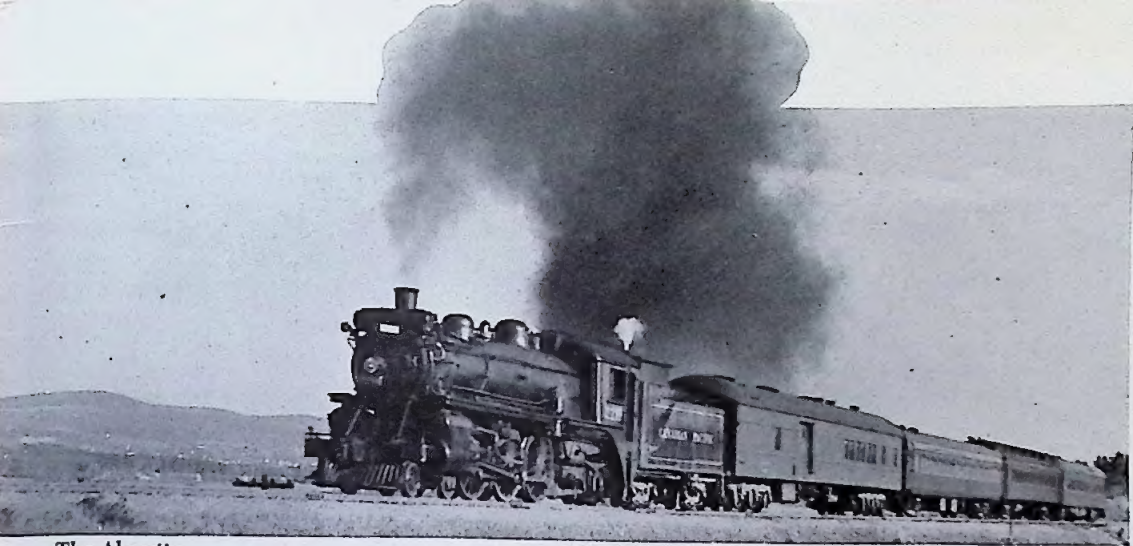
There was wider range in the quality of their dining-car service. On one widely advertised train of the Midwest he was offered his choice of creamed chicken, a hot chicken sandwich or chicken salad for lunch—nothing else. Fortunately he likes chicken! But he did not like the chicken that was served him that day, in that rather elaborate dining car. He tried it two ways. . . . The steak sandwich on the *Lackawanna Limited* was far better and he was amused by the naive notice on the menu card saying that the railroad was offering lunch at 90 cents and dinner at a dollar-ten, not because it wished to do it, but because it was compelled to do so by the O. P. A.!

He had good ham and eggs for breakfast on the *Century* and perhaps an even finer mess of ham-an' on the nice old-fashioned *Alouette*. But the *Alouette* was fashioned entirely of Canadian Pacific equipment—even to the very handsome locomotive—and its diner-lounge-observation car was stocked at the Montreal base, in a neighboring land which knows naught of food or gasoline shortages—or of O. P. A.'s and O. D. T.'s and all the rest of it.

The Burlington's *Zephyr* served a very good potroast as it rushed along the lovely east bank of the Mississippi north of Dubuque, but this department's accolade for the month must go to the Chicago & North Western's "*Commuter 400*." Its scrambled eggs for breakfast were supremely good.

Here is one of the finest developments of the Diesel streamliner yet made. It has brought into use here a practical development of a railway operating principle that long since obtained in Great Britain—that is, the intensive use of passenger equipment. Trains over there do not as a rule stand idle for long hours in terminal stations. As quickly as possible at the end of a run, they are turned and sent either back or elsewhere, to earn fresh revenues for their owners. Too many times here in the United States we have done it the other way. Operating men, living in deathly fear of the measuring rule of the train-mile, have permitted trains to stand idle many hours each day, instead of earning more money for their proprietors.

THEY do rather differently with those trim "*400*'s" of the North Western. That road now has five Diesel-powered units in daily operation. On two of these the locomotives outdo the train mileage.



The Alouette. Railroad Photographs, 47 Royal St., Allston, Mass.; by H. W. Pontin.

They haul the Twin Cities *"400"* each day between Chicago and the Twin Cities, 419 miles, and return to their start by hauling the overnight run of the *North Western Limited* between those same cities —a total run for each of the two engines of 838 miles, each 24 hours. . . . The three other Diesel streamliners perform good services —1789 miles a day for the three of them—but none of them quite equals that 838-mile record of the locomotives. Two of them make seven local trips daily between Chicago and Milwaukee (85 miles) as well as a round trip between Chicago and Green Bay (214 miles) and a local run between Milwaukee and Madison (82 miles) and between Madison and Chicago (130 miles). . . . The third Diesel streamliner, yclept the *Peninsula "400,"* runs daily from Ishpeming to Chicago and return (377 miles on the going route and 391 miles on the return). This ends the daily performance of all the North Western's five Diesel passenger engines —a fairly impressive total of 2627 miles. . . . A fourth streamliner, the *Minnesota "400,"* runs daily from Mankato, Minn., to Wyeville, Wis., where it makes connections with the original *"400's"* between Chicago and the Twin Cities; but for the present at least it is steam-hauled for its daily run of 382 miles. Every one of these trains is supplied with dining cars and other comfortable lounge facilities. Built by Pullman, they represent pretty nearly the ultimate in railroad passenger equipment.

This is good railroading, good railroading with a vengeance. Keeping the wheels turning—and the money coming in. Ralph Budd, president of the Burlington, had the idea even before the North Western. The Burlington installed one of its earliest *Zephyrs* for a daytime round trip run between Chicago and St. Paul and Minneapolis (437 miles in each direction) and it so prospered from the beginning that presently another *Zephyr* was ordered and a "double-daily was installed—and also prospered, instantly.

THE nice old-fashioned *Alouette*, that took me the other day from Boston up into northern Vermont, continues on to Montreal and by the grace of God makes the 340-mile run in 11 hours. It might take longer but it is hard to imagine just how. The week before I had ridden from St. Paul to Chicago on the Burlington's *Zephyrs*—427 miles in just 6½ hours, including eight or nine stops. That was traveling. . . . Perhaps when the war is done the Boston & Maine and the Canadian Pacific will put their heads together and either speed up the *Alouette* or, better still, let it continue its nice old-fashioned way, with all of its many local stops, and put a swift streamliner in service between Boston and Montreal. The run should not take more than seven or, at the very longest, eight hours. And additional train service is very much needed in northern New England. The suggestion is offered for what it is worth. Both Boston & Maine and Canadian Pacific are extremely progressive railroads. They have shown themselves, previous to the coming of the war, anxious not only to maintain their passenger service, but to improve and increase it.

For the record it should be added that there is another day train between Boston and Montreal—the *Ambassador*, of the Boston & Maine, the Central Vermont and the Canadian National Railways — which pursues a slightly shorter route but which still manages to use 9 hours 40 minutes to make the run. It is a good train, a very good train, and it has its partisans. . . . The third route, by way of the Rutland, has sunk into decadence. Its local train takes 10 hours 45 minutes for the run. Boston & Maine handles all three trains.

Boston & Maine is a good railroad—not asleep to these things. It made quite a step when, after a good many years of discussion, it aided in the installation of the lovely yellow-and-gold day train, the *East Wind*, between Washington, New York and Maine. . . . The *East Wind* is one of the casualties of the present wartime situation. When peace returns, it too will return, with the interesting possibility that it may become an all-year train instead of merely a Summer affair. There would seem to be more than enough business to justify it the entire year 'round.

Edward Hungerford

7 things you should do to keep prices down!

If prices soar, this war will last longer, and we could all go broke when it's over. Uncle Sam is fighting hard to keep prices *down*. But he can't do it alone. It's up to *you* to battle against any and every rising price! To help win the war and keep it from being a hollow victory afterward—you must *keep prices down*. And here's how you can do it:

1. BUY ONLY WHAT YOU NEED

Don't buy *a thing* unless you *cannot* get along without it. Spending can't create more goods. It makes them scarce and prices go up. So make everything you own last longer. "Use it up, wear it out, make it do, or do without."

2. PAY NO MORE THAN CEILING PRICES

If you do pay more, you're party to a black market that boosts prices. And if prices go up through the ceiling, your money will be worth less. Buy rationed goods only with stamps.

3. SUPPORT HIGHER TAXES

It's easier and cheaper to pay for the war as you go. And it's better to pay big taxes *now*—while you have the extra money to do it. Every dollar put into taxes means a dollar less to bid for scarce goods and boost prices.

4. PAY OFF OLD DEBTS

Paid-off debts make you independent now . . . and make your position a whale of a lot safer against the day you may be earning less. So pay off every cent you owe—and avoid making new debts as you'd avoid heiling Hitler!

5. DON'T ASK MORE MONEY

in wages, or in prices for goods you have to sell. That puts prices up for the things all of us buy. We're all in this war together—business men, farmers and workers. Increases come out of everybody's pocket—including *yours*.

6. SAVE FOR THE FUTURE

Money in the savings bank will come in handy for emergencies. And money in life insurance protects your family, protects you in old age. See that you're ready to meet any situation.

7. BUY WAR BONDS

and hold them. Buy as many as you can. Then cut corners to buy more. Bonds put money to work fighting the war instead of letting it shove up prices. They mean safety for you tomorrow. And they'll help keep prices down today.

KEEP PRICES DOWN . . .

Use it up . . . Wear it out . . .
Make it do . . . Or do without.

This advertisement, prepared by the War Advertising Council, is contributed by this magazine in cooperation with the Magazine Publishers of America.

Correspondence

In "The Multiple-Unit Electric Train" [June TRAINS] it was stated that the limit of length of New Haven M. U. trains is 14 cars because of the direct current used while on NYC tracks. But the NYC runs 16 cars. Why can the NYC run two more cars than the New Haven, and why does D. C. put a limitation on New Haven train length when 11,000-volt A. C. does not limit the length so severely?

Robert Caforek, 3 Main St., Yorkville, N. Y.

[Mr. Caforek's letter was referred to the New Haven Railroad for reply. Here it is, from D. W. Norris, publicity representative: "Our mechanical department advises that there are two reasons for 14-car trains as compared to the New York Central 16-car trains: First, our cars are considerably longer and therefore 14 of them run about the same as 16 of the NYC M. U. cars. Second, it is not possible to charge the batteries on the NH M. U. cars when they are running on the third rail into Grand Central. Therefore we must depend on the battery charge gain while operating on A. C. This, of course, limits somewhat the load that we can pull while running on D. C."—*Ed.*]

. . . Long M. U. trains in California: 10 cars, Southern Pacific electric; 14 cars, Northwestern Pacific (last run); 18 or more cars, Sacramento Northern (picnic train, about 1916). . . . Trains have undoubtedly been longer, but these are for sure. Fred Fellow Jr., 1282 Carlotta Ave., Berkeley, Calif.

I must call your attention to a slight error in "West Point Route." The author states, "At Atlanta the West Point Route connects with the *small Georgia Railroad* . . . " and there is where we disagree. Using the *Pocket List of Railroad Officials*, I have compiled the following comparison of the two roads:

	West Point	Georgia
Mileage operated	227	329
Number of locomotives	46	52
Number of freight cars	939	1081
Number of passenger cars	47	35

You can readily see that the Georgia is no "small" railroad in comparison, but in reality is larger than the two companies forming the West Point Route.

William H. Mims, Draftsman, Georgia Railroad. 1434 Pendleton Rd., Augusta, Ga.

With thousands of servicemen riding the trains for the first time, the understanding and interest in railroad problems should be greatly widened. Cpl. Howard A. Little, U. S. Army.

On page 5 of April TRAINS is a photo of SP 633. Can you tell me what the connection is that comes out of the left side of the smoke box and extends back to the cab? . . . I have been overhauling engines for many years and this is the first time I have observed a connection like this.

D. C. Orr, Roundhouse Foreman, 6330 Dorchester Ave., Chicago, Ill.

[The question was referred to the Southern Pacific, whose reply, from F. Q. Tredway, general advertising manager, is: "Mr. B. M. Brown, general superintendent of motive power, states that this is a pipe carrying superheated steam from the superheater header back to a superheated steam turret located on top of the boiler just ahead of the cab. On these engines the auxiliaries use superheated steam and are supplied from this superheated turret, which receives its supply by means of the external pipe. On most of our engines this pipe is carried underneath the skyline casing, so it is not so visible."—*Ed.*]

The last of the Colorado & Southern narrow-gauge in Denver was pulled up the week before Christmas, 1942. . . . The engines were overhauled, renumbered, and sent to the White Pass & Yukon. [See page 36.—*Ed.*] Recently I was down by the C&S rip track and saw about 10 old narrow-gauge cars being re-sided, refloored, and reroofed, and some of them have been given a coat of olive drab paint, so they will follow the engines. As for the narrow-gauge in Colorado, I'm afraid there will be very little left by 1953. Thomas Wallis, 160 W. Alaska Pl., Denver, Colo.

Renew Now!

If your subscription to TRAINS expires between now and January [expiration date is stamped on the envelope with your address], you will help us with our wartime problems by renewing *now*. Almost all of our subscriptions expire in Winter months, and this huge seasonal load not only causes much overtime for our regular subscription clerks but also normally requires extra help. But this year there can be no extra help, and the filling of subscription orders may fall 'way behind unless some of you help out by sending your orders early.

The six B&O postcards, reproductions of etchings, show outstanding events in the history of America's first common-carrier railroad, featuring locomotives of the various periods. These cards, excellent for your collection, will be sent for 25 cents per set.

Copies of Kent Day Coes' watercolor, "New York, Ontario & Western Freight," as in this issue of TRAINS but printed on heavy paper and unfolded, can be had for $1 postpaid. We also have similar copies of the Gil Reid watercolor, "Noonday Water Stop," from the June issue, also at $1 each. Both reproductions have wide margins so they can be trimmed to suit for framing.

The printing of a full-color painting in a small-circulation magazine such as ours must be done one color at a time. Each color must be printed in exactly the right position over its predecessor, and each must be inked to just the right intensity of color. And not until the final blue is printed can the finished job be seen. Quite a ticklish job for Ed Riebau, our head pressman, but you'll agree he's equal to it.

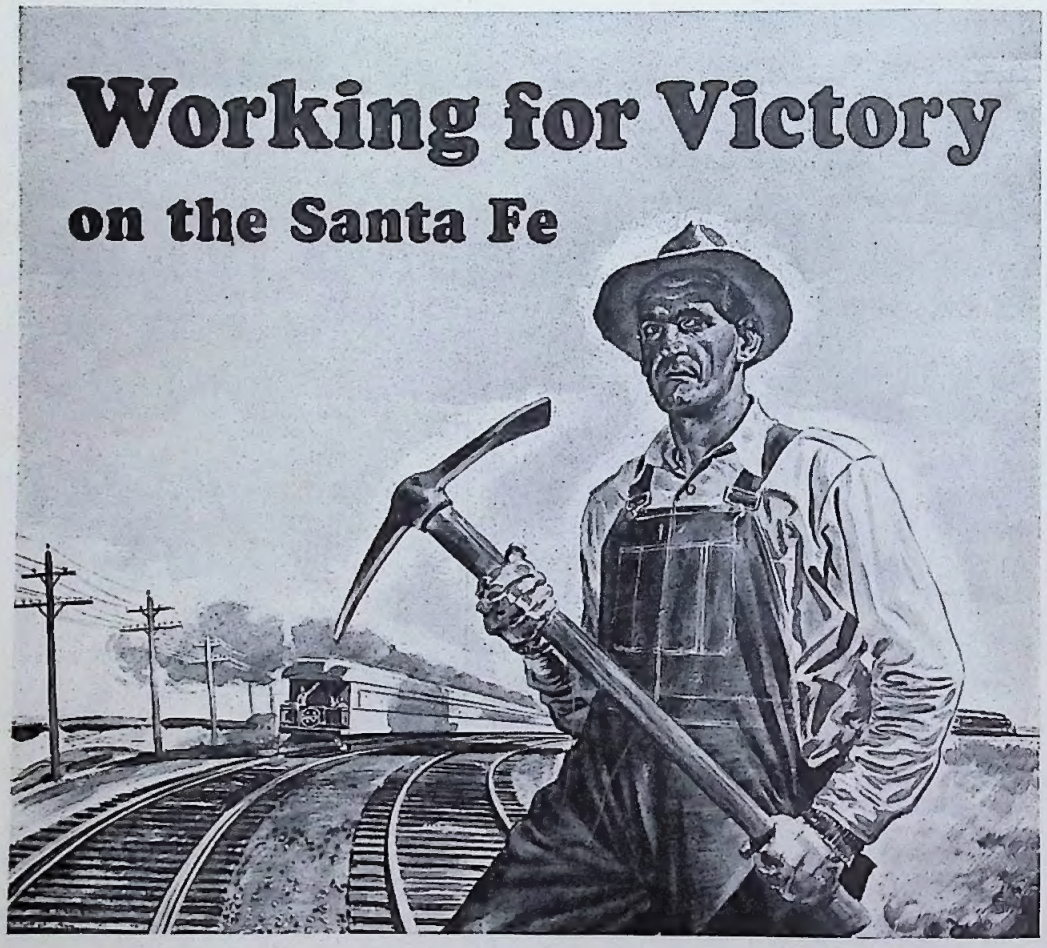
Have you seen our latest complete catalog of railroad books? A copy has been sent to every direct-mail subscriber, and will also be sent on request to anyone else.

Buy MORE War Bonds!

Kalmbach Publishing Co.
1027 N. 7th St. Milwaukee 3, Wis.

Working for Victory

on the Santa Fe



Through these hectic days and busy nights, troop trains, regular trains with troop cars, and freights loaded with war materials keep rolling along the Santa Fe.

Watch a section hand grab his pick a little tighter after a trainload of American fighting boys has rolled past. "We'll-get-'em-through" is his attitude these days.

Yet—he is only one of more than 60,000 employes on the Santa Fe who are doing their bit "keeping 'em rolling" all along the line... moving millions of troops and millions of tons of materials needed for Victory, where and when they are needed.

They know that *if you stop the wheels that move them, you stop everything that floats and flies as well!*

And they never forget that thousands of boys in our armed forces came from Santa Fe ranks and from the families of Santa Fe employes, and these boys who are fighting for all of us have the toughest job of all!

You bet, we're backing them up in the best way we know—and that's by buying War Bonds, and seeing to it that movements essential to Victory come *first* on the Santa Fe!

SANTA FE SYSTEM LINES

Serving the Southwest and California

ONE OF AMERICA'S RAILROADS—ALL UNITED FOR VICTORY

Santa Fe